ORIGINAL

NEW APPLICATION

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Arizona Corporation Commission
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To: Arizona Corporation Commission Office of Railroad Safety
Attn: Chris Watson
1200 W. Washington Street
Phoenix, AZ 85007

Date: August 5, 2009

Subject: Arizona Corporation Commission Application for UPRR Roadway Crossing at Recker Road (UPRR Folder No. 2538-74)

Attachments:
1) 8 ½"x11" conceptual drawing
2) Construction cost estimate of grade separated crossing
3) Executed agreement between Town of Gilbert and UPRR dated 4/16/09
4) Cooley Station Traffic Impact Study by TASK Engineering

RR-03639A-09-0393

Project: Recker and Williams Field Road Improvements

Project Number: Town of Gilbert CIP ST095
AZTEC Project No. AZE0703
UPRR Folder No. 2538-74

From: Robert Lyons, P.E.

This memo is submitted to the Arizona Corporation Commission (ACC) as an application to request an upgrade to an existing Union Pacific Railroad (UPRR) crossing, on behalf of the Town of Gilbert. Below is information based on the most current ACC application instructions.

1. **Location of crossing**
   The project improvements include widening Recker Road to a four lane roadway with a 16-foot wide raised median across the UPRR right-of-way. The UPRR and Recker Road crossing is approximately 2770 feet south of the Williams Field Road centerline. Representatives from the ACC, UPRR, Town of Gilbert, and consultants attended a field meeting on August 27, 2007.

2. **Why the crossing is needed**
   The railroad crossing at Recker Road is an existing two lane crossing. Projected traffic volumes on Recker Road require the addition of more lanes on Recker Road. This project includes widening of the existing crossing.

3. **Why the existing crossing cannot be grade separated**
   With the proposed improvements to Recker Road, the location of the at-grade crossing remains unchanged. A grade separation would have the following consequences: 1) Impact to 69kV and 230 kV overhead power lines currently running parallel to the railroad; 2) Impact to underground utilities in Recker Road that cannot support 30 feet of additional embankment needed for a grade-separated crossing. Among these utilities are a critical 42-inch reclaimed waterline, a 16-inch reclaimed waterline and a 24-inch high pressure natural gas line; 3) There is insufficient right-of-way to accommodate the 30-foot high embankment slopes along Recker Road; 4) There is inadequate distance between the railroad and the Higley Unified School District entrance (approximately 550 feet south of the tracks) to raise the roadway grade over the railroad without violating sight-distance requirements; 5) Grade separating the crossing would eliminate private access to Recker Road for 600 to 700 feet north of the tracks; and 6) Elevating Recker Road would cause visual and noise impacts to the adjacent land uses, which include residential.

4. **Type of warning devices to be installed**
   The warning devices for north bound and south bound traffic included in the design are as follows: gates with flashing lights will be installed outside the roadway near the sidewalk; cantilever flashing railroad signals will be installed outside the roadway near the sidewalk; railroad crossing warning signs will be placed per MUTCD, Part 8 standards; and the UPRR equipment shed will be relocated.

5. **Type of warning devices currently installed at crossing**
   The warning devices currently installed at the crossing include gates with flashing lights located outside the existing roadway. These will be removed by UPRR when they install the new warning devices described in question 4 above.

6. **Who will maintain the crossing warning devices**
   UPRR will own and maintain the physical elements of the crossing (crossing surface, gates, flashing lights). The Town of Gilbert will own and maintain the approaching roadway surface, signing and pavement markings on Recker Road.

7. **Who is funding the project**
   The Town of Gilbert is funding this project.

Below are responses to additional questions that may also be requested by the ACC:

8. **Provide average daily traffic counts for this location.**

Existing (2008):	8,614 vehicles per day, from the Town of Gilbert traffic count web page, http://www.ci.gilbert.az.us/traffic/counts08.cfm
2025:	17,170 vehicles per day (*August 16, 2006; revised November 16, 2006, Cooley Station Traffic Impact Study*, by Task Engineering.)

9. **Please describe the current level of service (LOS) at this intersection, and what the LOS will be with the proposed alterations to the intersection.**

Current LOS:	B/C
Proposed LOS:	B/C

10. **Provide any traffic studies done by the road authorities for each area.**
    Task Engineering prepared the *August 16, 2006; revised November 16, 2006, Cooley Station Traffic Impact Study.* This report is attached to this memo.

11. **Provide distances in miles to the next public crossing on either side of the proposed project location. Are any of these grade separations?**
    The next roadway crossing to the northwest is at Williams Field Road, which is an at-grade crossing, located approximately one mile from the Recker/UPRR crossing.

    The next roadway crossing to the southeast is at Pecos & Power Road intersection, which is an at-grade crossing, located approximately one mile from the Recker/UPRR crossing. The Pecos Road crossing was recently improved as well.

12. **How and why was grade separation not decided on at this time? Please provide any studies that were done to support these answers.**
    The Town's design consultant evaluated the impacts and estimated costs associated with a grade-separation. The items listed in response to Question No. 3 support the request to improve the existing at-grade crossing at this location.

    In addition, the following economic items (http://www.fra.dot.gov/us/Content/817, page 35) were considered:

Potential Economic Benefit	Response
Eliminating train/vehicle collisions (including the resultant property damage and medical costs, and liability)	As May 31, 2009, no accidents have been reported at this crossing over the last 20 years per the Federal Railway Administration website, http://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/gxrtop50.aspx.
Savings in highway-rail grade crossing surface and crossing signal installation and maintenance costs	This would not be a significant savings because the surface and signal work is about $1M compared to about $30M for a grade separation.
Driver delay cost savings	Based on 1 mile of train, 6 times per day, at 45 mph, driver delay cost savings would be relatively minor (average delay time is 1.3 minutes).
Costs associated with providing increased highway storage capacity (to accommodate traffic backed up by a train)	Storage capacity required for the railroad has not been evaluated and therefore costs savings cannot be determined.
Fuel and pollution mitigation cost savings (from idling queued vehicles)	Based on 1 mile of train, 6 times per day, at 45 mph, fuel and pollution mitigation cost savings would be relatively minor.
Effects of any "spillover" congestion on the rest of the roadway system	Spillover congestion may impact northbound and southbound queues through Higley Unified School District Driveway and the Chaparral Elementary Driveway. Spillover congestion may also impact Frye Road and the future Somerton Blvd.
The benefits of improved emergency access	See response to question 18.
The potential for closing one or more additional adjacent crossings	Adjacent streets Williams Field Road and Power Road cannot be closed because they are major arterials of regional significance and provide access to major destinations (L202 freeway, Phoenix-Mesa Gateway Airport, Arizona State University Ease, and Maricopa Community College).
Possible train derailment costs	No derailments have been reported per http://safetydata.fra.dot.gov/OfficeofSafety/default.aspx, and therefore associated cost savings are cannot be determined.

13. If this crossing was grade separated, provide a cost estimate of the project.
The total estimated construction, design, construction administration, and right-of-way cost is estimated to be $30,243,537. *The details of this estimate are attached to this memo.*

14. Please describe what the surrounding areas are zoned for near this intersection. I.e. Are there going to be new housing developments, industrial parks etc.
The surrounding area includes a mixture of multi-family/low density residential (MF/L), multi-family/medium density residential (MF/M), single family-6 residential (SF-6), single family-7 residential (SF-7), single family detached residential (SF-D), Gateway Village Center (GVC), Gateway Business

Center (GBC) and public facility/institutions (PF/I), from the Town of Gilbert Planning & Development web page, http://www.ci.gilbert.az.us/planning/pdf/zoningmap_11-08.pdf. The area north of the crossing is currently being developed and plans have been submitted for "Cooley Station, Village Center and Business Park".

15. **Please supply the following: number of daily train movements through the crossing, speed of the trains, and the type of movements being made (i.e. thru freight or switching). Is this a passenger train route?**
From a 3/31/08 e-mail from Jim Smith/UPRR: The track is used for through freight service and there are an average of 6 trains per day. Maximum train speeds are 60 mph. The Union Pacific does not have any plans to construct a second track at this crossing at this time but will need to maintain the ability to add a second track if future expansion is needed. This is not a passenger train route. This information was also confirmed with Aziz Aman/UPRR on 5/28/2009.

16. **Please provide the names and locations of all schools (elementary, junior high and high school) within the area of the crossing.**
The crossing is within two school districts, Higley Unified School District No. 60 and Gilbert Unified School District No. 41. Schools located within these districts and a three mile radius of the crossing are listed as follows:

Elementary: Higley Elementary - 3391 E. Vest Avenue
Chaparral Elementary – 3380 E. Frye Road
Cortina Elementary – 19680 S. 188th Street
Eagles Aerie School – 17019 S. Greenfield Road
Gateway Pointe Elementary – 2069 S. De La Torre Drive
Centennial Elementary – 3507 S. Ranch House Parkway
Coronado Elementary - 4333 S. Deanza Blvd
Power Ranch Elementary – 4351 S. Ranch House Parkway
SanTan Elementary – 3443 E. Calistoga Drive
Surrey Garden Christian School (k-12) – 1424 S. Promenade Lane

High School: Higley High School – 4068 E. Pecos Road
Perry High School – 1919 E. Queen Creek Road
Williams Field High School – 2076 S. Higley Road
Surrey Garden Christian School (k-12) – 1424 S. Promenade Lane

17. **Please provide school bus route information concerning the crossing, including the number of times a day a school bus crosses this crossing.**
Per a phone conversation with Mike McGuire, the Transportation Routing Coordinator for the Higley School District, there are 39 daily trips through this crossing.

18. **Please provide information about any hospitals in the area and whether the crossing is used extensively by emergency service vehicles.**
The main Hospitals and health facilities are as follows:

Hospitals: Gilbert Hospital - 5656 S Power Road
Mercy Gilbert Medical Center - 3555 S. Val Vista Dr.

Health Facilities: Urgent Care Express - 920 E. Williams Field
East Valley Urgent Care - 641 W. Warner Road

No data is available for the number of emergency vehicles crossing at this location.

19. **Please provide total cost of improvements to each crossing.**
This project's street improvement cost at the RR crossing is estimated at $139,000. The UPRR's estimated cost to the crossing is as follows:

• Railroad track & surface:	$296,367
• Railroad signal:	$553,899
• UPRR Sub-Total:	$850,266
• Roadway Improvements:	$139,000
• Total:	$989,266

These costs are based on the agreement dated 4/16/2009.

20. **Provide any information as to whether vehicles carrying hazardous materials utilize this crossing and the number of times a day they might cross it.**
No data is available for the number of vehicles carrying hazardous materials at this location.

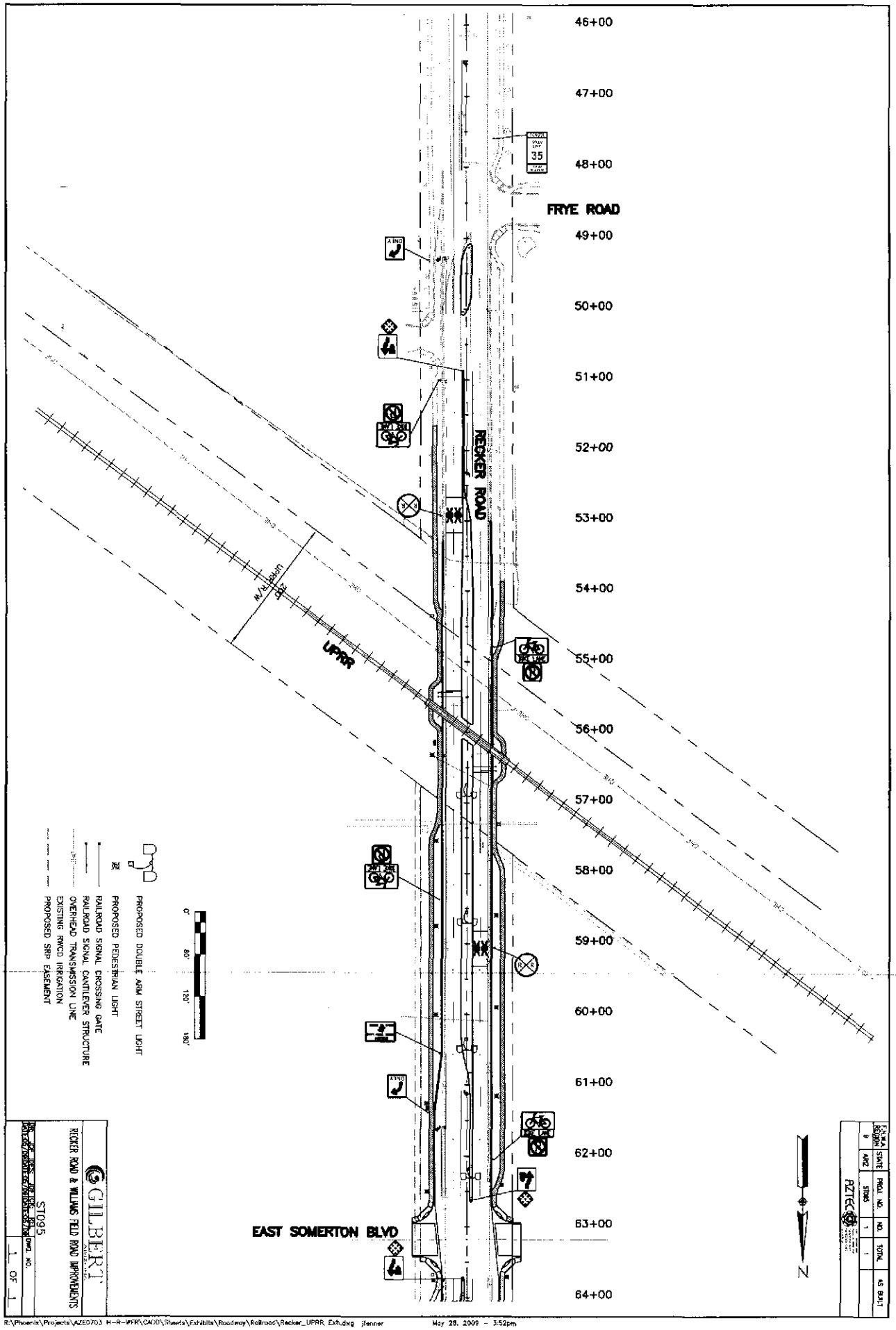
21. **Please Provide the posted vehicular speed limit for the roadway.**
45 mph

22. **Do any buses (other than school buses) utilize the crossing, and how many times a day do they cross the crossing.**
There are no public bus routes through this crossing at this time.

c: Rick Allred/Town of Gilbert
Project File: AZE0703

Attachment 1

8 ½" x 11" Conceptual Drawing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PROPOSED DOUBLE ARM STREET LIGHT
PROPOSED PEDESTRIAN LIGHT
RAILROAD SIGNAL CROSSING GATE
RAILROAD SIGNAL CANTILEVER STRUCTURE
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Attachment 2

Construction Cost Estimate of Grade Separate Crossing

Construction Cost Estimate of Grade Separated Crossing
Recker Road/UPRR Crossing

Recker Rd-Over-pass @ UPRR crossing

Item	Quantity	Unit	Unit Cost	Cost
Excavation	3,780.00	CY	$5.00	$18,900.00
Fill	165,280.00	CY	$5.00	$826,400.00
Bridge	13,500.00	SF	$200.00	$2,700,000.00
Retaining Wall	27,100.00	SF	$60.00	$1,626,000.00
Right-of-Way	64,000.00	SF	$7.00	$448,000.00
Subgrade Preparation	21,933.00	SY	$3.00	$65,799.00
Temporary Construction Easement	176,000.00	SF	$5.00	$880,000.00
ABC 18"	15,300.00	SY	$20.00	$306,000.00
AC 1-1/2"	15,300.00	SY	$9.00	$137,700.00
AC 2-1/2"	15,300.00	SY	$11.00	$168,300.00
Tack Coat	30.00	TON	$800.00	$24,000.00
Vertical Curb & Gutter	3,780.00	LF	$18.00	$68,040.00
Vertical Curb	2,200.00	LF	$15.00	$33,000.00
Concrete Sidewalk	18,600.00	SF	$5.00	$93,000.00
Driveway Entrance	4.00	EA	$10,000.00	$40,000.00
Median Nose	2.00	EA	$1,000.00	$2,000.00
Median Brick Pavers	15,400.00	SF	$20.00	$308,000.00
Landscaping	1.00	LS	$500,000.00	$500,000.00
Relocate Sewer Mains	700.00	LF	$120.00	$84,000.00
Relocate Water Mains	5,000.00	LF	$100.00	$500,000.00
Other Utility Relocations	1.00	LS	$2,000,000.00	$2,000,000.00
Drainage	1.00	LS	$200,000.00	$200,000.00
Signing	1.00	LS	$20,000.00	$20,000.00
Striping	1.00	LS	$15,000.00	$15,000.00
Traffic Control	1.00	LS	$300,000.00	$300,000.00
Impact to adjacent Property Owners	1.00	LS	$1,000,000.00	$1,000,000.00
Electrical/Lighting	1.00	LS	$500,000.00	$500,000.00
230 KV Relocation	1.00	LS	$5,000,000.00	$5,000,000.00
12 KV & 64 KV Relocation	1.00	LS	$3,000,000.00	$3,000,000.00
RWCD Relocation	1.00	LS	$500,000.00	$500,000.00
			SUB TOTAL - RECKER	*$21,364,139.00*

Frye Road

Item	Quantity	Unit	Unit Cost	Cost
Excavation	1,000.00	CY	$5.00	$5,000.00
Fill	9,000.00	CY	$5.00	$45,000.00
Retaining Walls	6,000.00	SF	$60.00	$360,000.00
Temporary Construction Easement	60,000.00	SF	$5.00	$300,000.00
Vertical Curb & Gutter	1,200.00	LF	$18.00	$21,600.00
6' Concrete Sidewalk	7,200.00	SF	$5.00	$36,000.00
Subgrade Preparation	4,067.00	SY	$3.00	$12,201.00
ABC 18"	6,267.00	SY	$20.00	$125,340.00
AC 1-1/2"	6,267.00	SY	$9.00	$56,403.00
AC 2-1/2"	6,267.00	SY	$11.00	$68,937.00
Tack Coat	10.00	TON	$800.00	$8,000.00
			SUB TOTAL - FRYE	*$1,038,481.00*
			SUB TOTAL	*$22,402,620.00*

General Items

Item	Quantity	Unit	Unit Cost	Cost
Mobilization (10%)	1.00	LS	$2,240,262.00	$2,240,262.00
Administration (15%)	1.00	LS	$3,360,393.00	$3,360,393.00
Design (10%)	1.00	LS	$2,240,262.00	$2,240,262.00
			SUB TOTAL - GENERAL	*$7,840,917.00*
			TOTAL	*$30,243,537.00*

Attachment 3

Executed Agreement between Town of Gilbert and UPRR dated 4-16-09

April 16, 2009

UPRR Folder No. 2538-74

MR RICK ALLRED
TOWN OF GILBERT
90 E CIVIC CENTER DR
GILBERT AZ 85296

Dear Mr. Allred:

Attached is your original copy of a *Supplemental Agreement*, fully executed on behalf of the Railroad Company.

In order to protect the Railroad Company's property as well as for safety reasons, it is imperative that you notify the Railroad Company's Manager of Track Maintenance and the Communications Department:

Aziz Aman
Manager Public Projects
Union Pacific Railroad Company
2073 East Jade Drive
Chandler, AZ 85286
Phone: 480- 415- 2364
aaman@up.com

Fiber Optics Hot Line
1-800-336-9193

If you have any questions, please contact me.

Sincerely Yours,

PAUL G. FARRELL
Senior Manager Contracts
phone: (402) 544-8620
e-mail: *pgfarrell@up.com*

Real Estate Department
UNION PACIFIC RAILROAD COMPANY
1400 Douglas Street, MS 1690
Omaha, Nebraska 68179-1690
fax 402.501.0340

UPRR Folder No.: 2538-74

UPRR Audit No. **250454**

SUPPLEMENTAL AGREEMENT

(EXISTING PUBLIC ROAD CROSSING IMPROVEMENT)

Contract No. 2009-7003-0320

THIS SUPPLEMENTAL AGREEMENT is made as of the 24th day of March, 2009, by and between ***UNION PACIFIC RAILROAD COMPANY***, a Delaware corporation, or its predecessor in interest ("Railroad") and the **TOWN OF GILBERT**, a municipal corporation of the State of Arizona ("Town").

RECITALS:

By instrument dated May 29, 1928, the Phoenix & Eastern Railroad Company and the County of Maricopa entered into an agreement (the "Original Agreement"), identified in the records of the Railroad as Folder No. 2538-74, Audit No. 250454, covering the construction, use, maintenance and repair of an at grade public road crossing, known as Recker Road, DOT No. 741-832M, at Railroad's Mile Post 933.15 on it's Phoenix Subdivision, in Maricopa County, near the Town of Gilbert, Arizona.

The Railroad named herein is successor in interest to the Phoenix & Eastern Railroad Company, and the Town herein is successor in interest to the County of Maricopa.

The Town now desires to undertake as its project (the "Project"):

- the reconstruction and widening of the road crossing that was constructed under the Original Agreement. The structure, as reconstructed and widened is hereinafter the "Roadway" and where the Roadway crosses the Railroad's property is the "Crossing Area."

The right of way granted by Phoenix & Eastern Railroad Company to the County under the terms of the Original Agreement is not sufficient to allow for the reconstruction and widening of the road crossing constructed under the Original Agreement. Therefore, under this Agreement, the Railroad will be granting an additional right of way right to the Town to facilitate the reconstruction and widening of the road crossing. The portion of Railroad's property that Town needs a right to use in connection with the road crossing (including the right of way area covered under the Original Agreement) is shown on the Railroad Location Print marked **Exhibit A**, the Detailed Print marked **Exhibit A-1**, described in the Legal Description marked **Exhibit A-2**, and illustrated on the Illustrative Print of the Legal Description marked **Exhibit A-3**, with each exhibit being attached hereto and hereby made a part hereof (the "Crossing Area").

The Railroad and the Town are entering into this Agreement to cover the above.

AGREEMENT:

NOW THEREFORE, in consideration of the premises and of the promises and conditions hereinafter set forth, the parties hereto agree as follows:

SECTION 1.

The exhibits below are attached hereto and hereby made a part hereof.

Exhibit A	Railroad Location Print
Exhibit A-1	Detailed/Specification Print
Exhibit A-2	Legal Description
Exhibit A-3	Illustrative Print of Legal Description
Exhibit B	Railroad's Track & Surface Material Estimate
Exhibit B-1	Railroad's Signal Material Estimate
Exhibit C	Railroad Form of Contractor's Right of Entry Agreement

SECTION 2.

The Railroad, at Town's expense, shall furnish all labor, material, equipment and supervision for the Roadway improvements:

- Re-lay 320-feet of track;
- Install 144-feet of concrete road crossing panels;
- Install 100 cross ties;
- Install 2 carloads of ballast and other track and surface materials;
- Install automatic flashing light crossing signals with gates and other signal matrials;
- Engineering, and
- Flagging.

SECTION 3.

A. The work to be performed by the Railroad, at the Town's sole cost and expense, is described as follows:

- Railroad's Track & Surface Material Estimate dated January 5, 2009, in the amount of $296,367.00, marked **Exhibit B**, and
- Railroad's Signal Material Estimate dated January 6, 2009, in the amount of $553,899.00, marked **Exhibit B-1**,

each attached hereto and hereby made a part hereof (collectively the "Estimate"). As set forth in the Estimate, the Railroad's combined estimated cost for the Railroad's work associated with the Project is ($850,266.00).

(each) attached hereto and hereby made a part hereof (collectively the "Estimate").

B. The Railroad, if it so elects, may recalculate and update the Estimate submitted to the Town in the event the Town does not commence construction on the portion of the Project located on the Railroad's property within six (6) months from the date of the Estimate.

C. The Town acknowledges that the Estimate does not include any estimate of flagging or other protective service costs that are to be paid by the Town or the Contractor in connection with flagging or other protective services provided by the Railroad in connection with the Project. All of such costs incurred by the Railroad are to be paid by the Town or the Contractor as determined by the Railroad and the Town. If it is determined that the Railroad will be billing the Contractor directly for such costs, the Town agrees that it will pay the Railroad for any

flagging costs that have not been paid by any Contractor within thirty (30) days of the Contractor's receipt of billing.

D. The Town agrees to reimburse the Railroad for one hundred percent (100%) of all actual costs incurred by the Railroad in connection with the Project including, but not limited to, actual costs of preliminary engineering review, construction inspection, procurement of materials, equipment rental, manpower and deliveries to the job site and all of the Railroad's normal and customary additives (which shall include direct and indirect overhead costs) associated therewith.

SECTION 4.

A. The Town, at its expense, shall prepare, or cause to be prepared by others, the detailed plans and specifications and submit such plans and specifications to the Railroad's Assistant Vice President Engineering – Design, or his authorized representative, for review and approval. The plans and specifications shall include all Roadway layout specifications, cross sections and elevations, associated drainage, and other appurtenances.

B. The final one hundred percent (100%) completed plans that are approved in writing by the Railroad's Assistant Vice President Engineering–Design, or his authorized representative, are hereinafter referred to as the "Plans". The Plans are hereby made a part of this Agreement by reference.

C. No changes in the Plans shall be made unless the Railroad has consented to such changes in writing.

D. Notwithstanding the Railroad's approval of the Plans, the Railroad shall not be responsible for the permitting, design, details or construction of the Roadway.

SECTION 5.

The Railroad, at the Town's expense, shall maintain the crossing between the track tie ends. If, in the future, the Town elects to have the surfacing material between the track tie ends replaced with paving or some surfacing material other than timber planking, the Railroad, at Town's expense, shall install such replacement surfacing.

SECTION 6.

A. The Town, at its sole cost and expense, shall provide traffic control, barricades, and all detour signing for the crossing work, provide all labor, material and equipment to install concrete or asphalt street approaches, and if required, will install advanced warning signs, and pavement markings in compliance and conformance with the Manual on Uniform Traffic Control Devices.

B. The Town, at its expense, shall maintain and repair all portions of the Roadway approaches that are not within the track tie ends.

SECTION 7.

If Town's contractor(s) is/are performing any work described in Section 6 above, then the Town shall require its contractor(s) to execute the Railroad's standard and current form of

Contractor's Right of Entry Agreement attached hereto as **Exhibit C**. Town acknowledges receipt of a copy of the Contractor's Right of Entry Agreement and understanding of its terms, provisions, and requirements, and will inform its contractor(s) of the need to execute the Agreement. Under no circumstances will the Town's contractor(s) be allowed onto the Railroad's premises without first executing the Contractor's Right of Entry Agreement.

SECTION 8.

Fiber optic cable systems may be buried on the Railroad's property. Protection of the fiber optic cable systems is of extreme importance since any break could disrupt service to users resulting in business interruption and loss of revenue and profits. Town or its contractor(s) shall telephone the Railroad during normal business hours (7:00 a.m. to 9:00 p.m., Central Time, Monday through Friday, except holidays) at 1-800-336-9193 (also a 24-hour number, 7 day number for emergency calls) to determine if fiber optic cable is buried anywhere on the Railroad's premises to be used by the Town or its contractor(s). If it is, Town or its contractor(s) will telephone the telecommunications company(ies) involved, arrange for a cable locator, and make arrangements for relocation or other protection of the fiber optic cable prior to beginning any work on the Railroad's premises.

SECTION 9.

The Town, for itself and for its successors and assigns, hereby waives any right of assessment against the Railroad, as an adjacent property owner, for any and all improvements made under this agreement.

SECTION 10.

Covenants herein shall inure to or bind each party's successors and assigns; provided, no right of the Town shall be transferred or assigned, either voluntarily or involuntarily, except by express prior written consent of the Railroad.

SECTION 11.

The Town shall, when returning this agreement to the Railroad (signed), cause same to be accompanied by such Order, Resolution, or Ordinance of the governing body of the Town, passed and approved as by law prescribed, and duly certified, evidencing the authority of the person executing this agreement on behalf of the Town with the power so to do, and which also will certify that funds have been appropriated and are available for the payment of any sums herein agreed to be paid by Town.

SECTION 12.

The Town agrees to reimburse the Railroad the cost of future maintenance of the automatic grade-crossing protection within thirty (30) days of the Town's receipt of billing.

SECTION 13.

For and in consideration **THREE THOUSAND NINE HUNDRED THIRTY-NINE DOLLARS ($3,939.00)** to be paid by the Town to the Railroad upon the execution and delivery of

this Agreement and in further consideration of the Town's agreement to perform and abide by the terms of this Agreement including all exhibits, the Railroad hereby grants to the Town the right to establish or reestablish, construct or reconstruct, maintain, repair and renew the road crossing over and across the Crossing Area.

SECTION 14.

This agreement is supplemental to the Original Agreement, as herein amended, and nothing herein contained shall be construed as amending or modifying the same except as herein specifically provided.

IN WITNESS WHEREOF, the parties hereto have caused this Supplemental Agreement to be executed as of the day and year first hereinabove written.

UNION PACIFIC RAILROAD COMPANY
(Federal Tax ID #94-6001323)

By: _____
JAMES P. GADE
Director Contracts

WITNESS:

Catherine A. Templeton

TOWN OF GILBERT

X _____

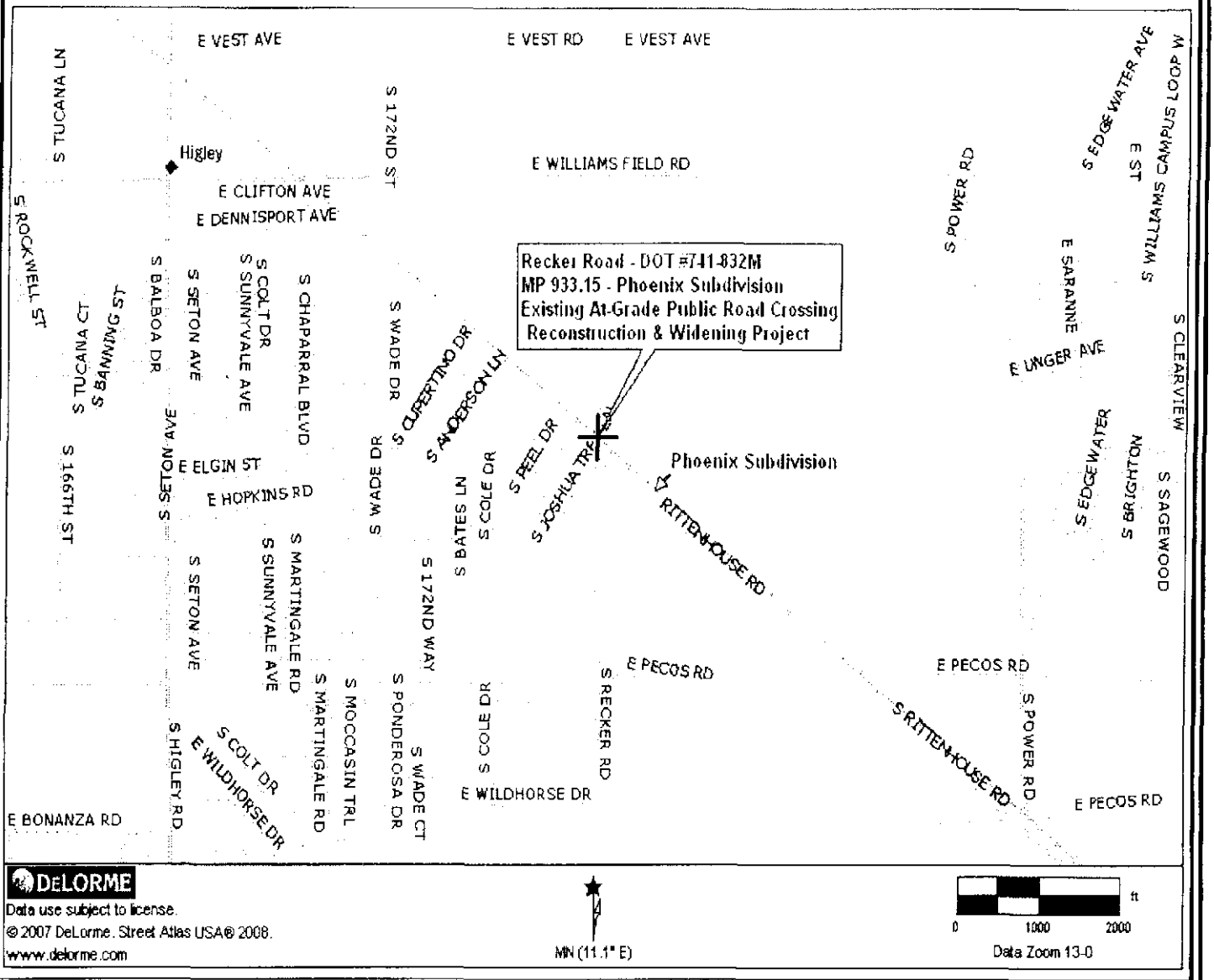
Title: Steven M. Berman, Mayor

EXHIBIT A

To Supplemental Agreement
(Existing Public Road Crossing Improvement)

Cover Sheet for the
Railroad Location Print

RAILROAD LOCATION PRINT
OF A PUBLIC ROAD CROSSING
CONSTRUCTION PROJECT



RAILROAD WORK TO BE PERFORMED:

1. Re-lay 320-feet of track; Install 144-feet of concrete road crossing panels; Install 100 cross ties; Install 2 carloads of ballast; and other track & surface materials.
2. Install automatic flashing light crossing signals with gates; Relocate existing gates, signals, conduits and other signal facilities; and other signal materials.
3. Engineering Design Review & Flagging.

BRIEF DESCRIPTION:

A parcel of land located in the East ½ of Section 35 and the SW¼ of Section 36, Township 1 South, Range 6 East of the Gila & Salt River Meridian, in Maricopa County, Arizona.

EXHIBIT "A"

UNION PACIFIC RAILROAD COMPANY

PHOENIX SUBDIVISION
MILE POST 933.15
GPS: N 33° 17.9740', W 111° 42.2248'
GILBERT, MARICOPA CO., AZ.

Location print of an existing at-grade public road crossing reconstruction, widening and improvement project with the **TOWN OF GILBERT.**

Folder No. 2538-74 Date: January 26, 2009

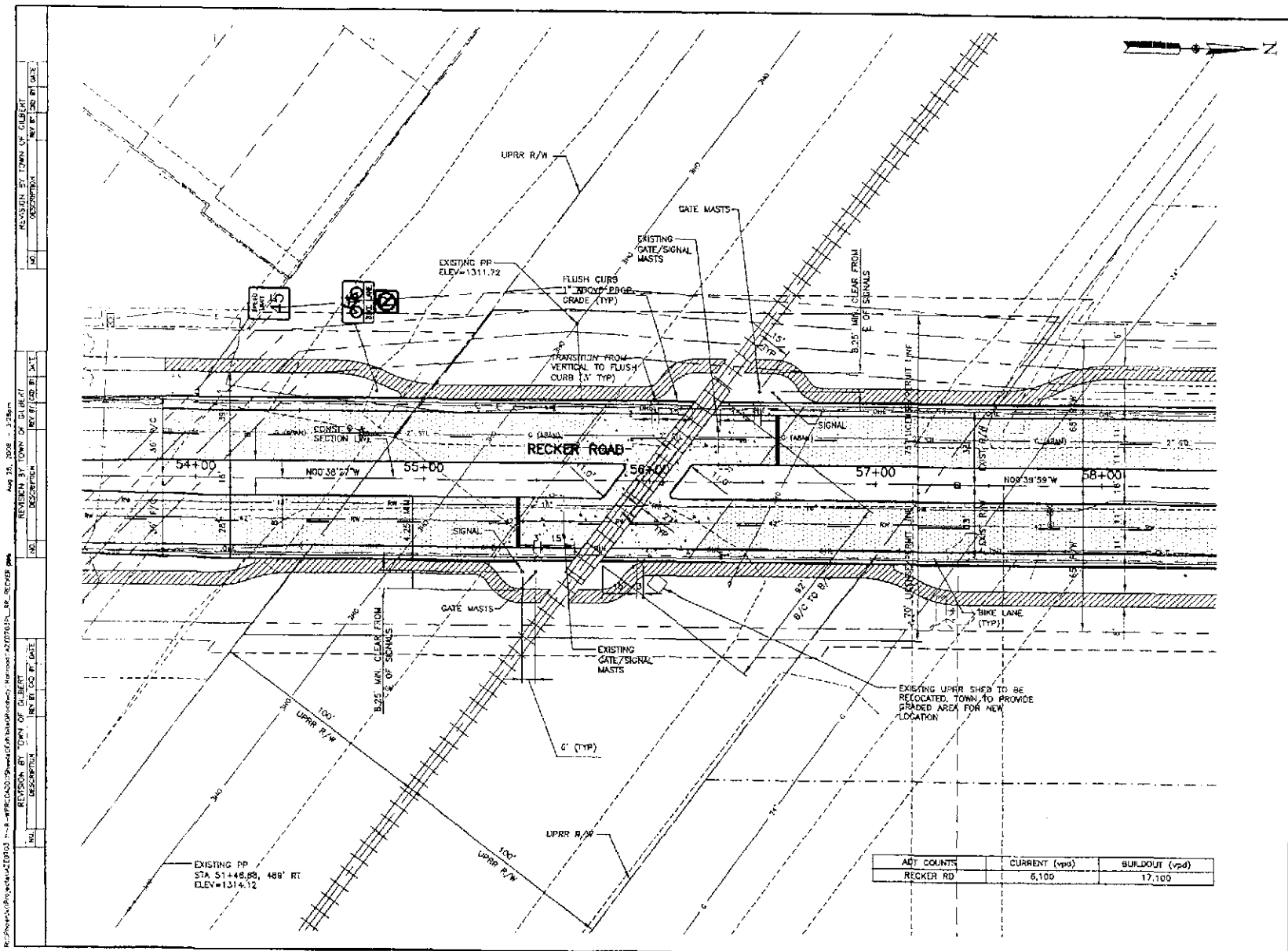
WARNING

IN ALL OCCASIONS, U.P. COMMUNICATIONS DEPARTMENT MUST BE CONTACTED IN ADVANCE OF ANY WORKS TO DETERMINE EXISTENCE AND LOCATION OF FIBER OPTIC CABLE
PHONE: 1-(800) 336-9193

EXHIBIT A-1

To Supplemental Agreement
(Existing Public Road Crossing Improvement)

Cover Sheet for the
Detailed Print



ADT COUNTS	CURRENT (vpd)	BUILDOUT (vpd)
RECKER RD	6,100	17,100

F.H.W.A. REGION	STATE	PROJ. NO.	NO.	TOTAL	AS BUILT
9	ARIZ	ST095		XX	

AZTEC

PRELIMINARY
60%
NOT FOR CONSTRUCTION OR RECORDING

602-263-1100
1-800-STAKE-IT

ROADWAY PLAN SHEET

GILBERT

RECKER ROAD & WILLIAMS FIELD ROAD IMPROVEMENTS

STA 53+50 TO STA 58+50

ST095

DWG. NO.

SCALE: 1"=20'

OF

REVISION BY TOWN OF GILBERT

NO.	DESCRIPTION	REV BY	DSD BY	DATE

Aug 15, 2008 - 3:28pm

Exhibit A-1
Detailed Print

EXHIBIT A-2

To Supplemental Agreement
(Existing Public Road Crossing Improvement)

Cover Sheet for the
Legal Description

EXHIBIT A
Legal Description
Right-of-Way

A parcel of land located in the East Half of Section 35 and the Southwest Quarter of Section 36, Township 1 South, Range 6 East of the Gila and Salt River Meridian, Maricopa County, Arizona, more particularly described as follows:

Commencing at the Southeast Corner of said Section 35, a Brass cap in a handhole, whence the East Quarter Corner of said Section 35, an Aluminum cap 0.2' down, bears N 00° 38' 27" W, a distance of 2636.04 feet;
THENCE along the East line of said Section 35, N 00° 38' 27" W, a distance of 2373.48 feet to the Southerly line of the Union Pacific Railroad Company Right-of-Way (UPROW), according to an Unrecorded map filed in Right-of-Way Serial No. AZPHX-0086615 and to the **TRUE POINT OF BEGINNING**;

THENCE leaving said East line, along said Southerly line, N 53° 37' 46" W, a distance of 93.92 feet to the West line of the East 75.00 feet of said Section 35;

THENCE leaving said Southerly line, along said West line, N 00° 38' 27" W, a distance of 250.47 feet to the Northerly line of said UPROW;

THENCE leaving said West line, along said Northerly line, S 53° 37' 46" E, a distance of 181.59 feet to the East line of the West 70.00 feet of said Section 36;

THENCE leaving said Northerly line, along said East line, S 00° 38' 27" E, a distance of 250.47 feet to said Southerly line;

THENCE leaving said East line, along said Southerly line, N 53° 37' 46" W, a distance of 87.66 feet to the **TRUE POINT OF BEGINNING.**

Containing 36,317 square feet (0.83 Ac.) ±.

This Description is located within an area surveyed by AZTEC in May-July 2007. And is also based on Maricopa County GDACS. Monumentation as noted in this Description is within acceptable standards (as defined in "Arizona Boundary Survey Minimum Standards") based on said survey.

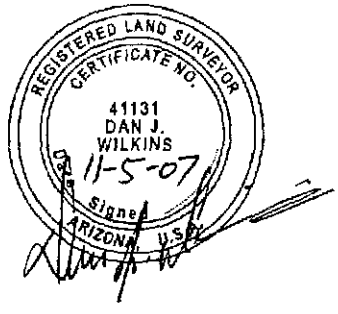
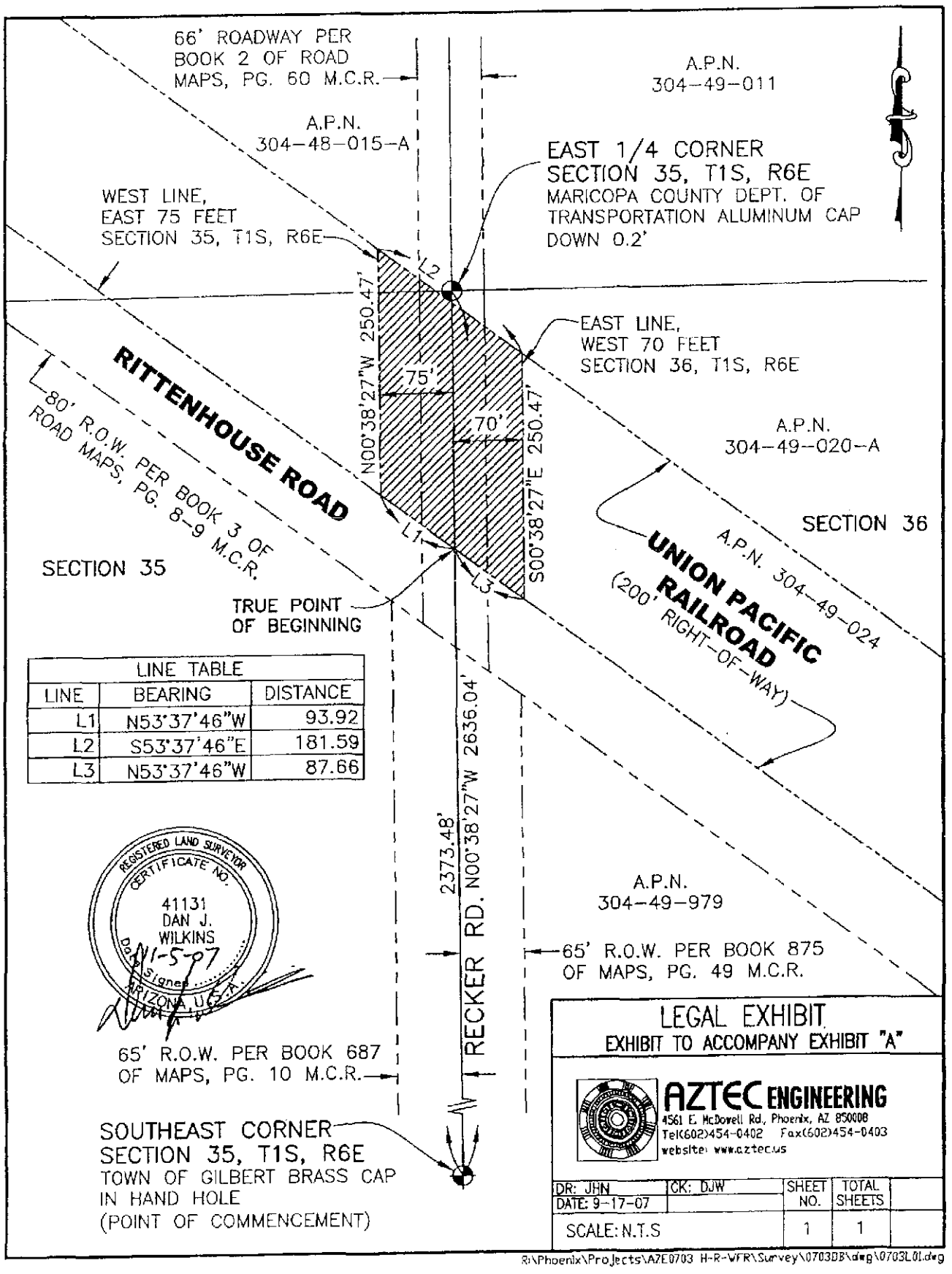


EXHIBIT A-3

To Supplemental Agreement
(Existing Public Road Crossing Improvement)

Cover Sheet for the
Illustrative Print of Legal Description



LINE TABLE		
LINE	BEARING	DISTANCE
L1	N53°37'46"W	93.92
L2	S53°37'46"E	181.59
L3	N53°37'46"W	87.66

LEGAL EXHIBIT

EXHIBIT TO ACCOMPANY EXHIBIT "A"

AZTEC ENGINEERING
4561 E. McDowell Rd., Phoenix, AZ 85008
Tel(602)454-0402 Fax(602)454-0403
website: www.aztec.us

DR: JHN	CK: DJW	SHEET NO.	TOTAL SHEETS
DATE: 9-17-07			
SCALE: N.T.S		1	1

R:\Phoenix\Projects\AZE0703 H-R-VFR\Survey\0703DB\dwg\0703L01.dwg

Exhibit A-3
Illustrative Print of Legal Description

EXHIBIT B

To Supplemental Agreement
(Existing Public Road Crossing Improvement)

Cover Sheet for the
Railroad's Track & Surface Material Estimate

DATE: 2009-01-05

ESTIMATE OF MATERIAL AND FORCE ACCOUNT WORK
BY THE
UNION PACIFIC RAILROAD

THIS ESTIMATE GOOD FOR 6 MONTHS EXPIRATION DATE IS :2009-07-06

DESCRIPTION OF WORK:
RECOLLECT ROAD CROSSING - PHOENIX SUB - MP 933.15 - RECKER RD.
100% RECOLLECT FROM TOWN OF GILBERT , AZ. USING FEDERAL ADDITIVES WITH
INDIRECT AND OVERHEAD CONSTRUCTION COST, 205%.
1 XING LOCATION = 144 TF OF CONCRETE XING
2 CARS OF BALLAST.

PID: 60169 AWO: 85361 MP,SUBDIV: 933.15, PHOENIX
SERVICE UNIT: 16 CITY: GILBERT STATE: AZ

DESCRIPTION	QTY	UNIT	LABOR	MATERIAL	RECOLL	UPRR	TOTAL
ENGINEERING WORK							
ENGINEERING			10000		10000		10000
LABOR ADDITIVE 205%			20500		20500		20500
TOTAL ENGINEERING			30500		30500		30500
SIGNAL WORK							
LABOR ADDITIVE 205%			2084		2084		2084
SALES TAX				2	2		2
SIGNAL			1017	69	1086		1086
TOTAL SIGNAL			3101	71	3172		3172
TRACK & SURFACE WORK							
BALAST	2.00	CL	2280	1521	3801		3801
BILL PREP				900	900		900
ENVIRONMENTAL PERMITS				1	1		1
FIELD WELD			350		350		350
HOMELINE FREIGHT				900	900		900
LABOR ADDITIVE 205%			86458		86458		86458
MATL STORE EXPENSE				474	474		474
OTM			2702	3071	5773		5773
RAIL	320.00	LF	3655	6915	10570		10570
RDXING	144.00	TF	17310	29416	46726		46726
SALES TAX				1992	1992		1992
SAW CUT STREET APPROACH				6000	6000		6000
TRAFFIC CONTROL				20000	20000		20000
TRK-SURF,LIN			8561		8561		8561
WELD			11320	254	11574		11574
XTIE	100.00	EA	22898	8717	31615		31615
10% CONTINGENCY				27000	27000		27000
TOTAL TRACK & SURFACE			155534	107161	262695		262695
LABOR/MATERIAL EXPENSE			189135	107232			
RECOLLECTIBLE/UPRR EXPENSE					296367	0	
ESTIMATED PROJECT COST							296367
EXISTING REUSEABLE MATERIAL CREDIT					0		
SALVAGE NONUSEABLE MATERIAL CREDIT					0		
RECOLLECTIBLE LESS CREDITS							

THE ABOVE FIGURES ARE ESTIMATES ONLY AND SUBJECT TO FLUCTUATION. IN THE EVENT OF AN INCREASE OR DECREASE IN THE COST OR QUANTITY OF MATERIAL OR LABOR REQUIRED,

Exhibit B
Railroad's Track & Surface Material Estimate

EXHIBIT B-1

To Supplemental Agreement
(Existing Public Road Crossing Improvement)

Cover Sheet for the
Railroad's Signal Material Estimate

DATE: 2009-01-06

ESTIMATE OF MATERIAL AND FORCE ACCOUNT WORK
BY THE
UNION PACIFIC RAILROAD

THIS ESTIMATE GOOD FOR 6 MONTHS EXPIRATION DATE IS :2009-07-07

DESCRIPTION OF WORK:
INSTALL AUTOMATIC FLASHING LIGHT CROSSING SIGNALS
WITH GATES AT GILBERT, AZ. RECKER ROAD M.P.933.15
ON THE PHOENIX SUB DOT#741 832N
WORK TO BE PERFORMED BY RAILROAD WITH EXPENSE AS BELOW:
SIGNAL & TRACK - TOWN OF GILBERT - 100%
ESTIMATED USING FEDERAL ADDITIVES WITH OVERHEAD & INDIRECT
CONSTRUCTION COST - SIGNAL 167.76% & TRACK 204.59%

PID: 60168 AFE: 85360 MP,SUBDIV: 933.15, PHOENIX
SERVICE UNIT: 16 CITY: GILBERT STATE: AZ

DESCRIPTION	QTY	UNIT	LABOR	MATERIAL	RECOLL	UPRR	TOTAL
ENGINEERING WORK							
BILL PREP			900		900		900
CONTRACT				9165	9165		9165
ENGINEERING			6210		6210		6210
ENVIRONMENTAL				1	1		1
INSTALL METER				1200	1200		1200
LABOR ADDITIVE 167.76%			214027		214027		214027
PERMITTING				67848	67848		67848
PRELIMINARY ENGINEERING				20000	20000		20000
ROCK/GRAVEL/FILL				1800	1800		1800
SIG-HWY XNG			119829		119829		119829
TRANSP/IB/OB/RCLM CONTR				13833	13833		13833
TOTAL ENGINEERING			340966	113847	454813		454813
SIGNAL WORK							
LABOR ADDITIVE 167.76%			1706		1706		1706
MATL STORE EXPENSE				4	4		4
SALES TAX				3552	3552		3552
SIGNAL			1017	88812	89829		89829
TOTAL SIGNAL			2723	92368	95091		95091
TRACK & SURFACE WORK							
FIELD WELD			48		48		48
MATL STORE EXPENSE				84	84		84
OTM			906	2590	3496		3496
SALES TAX				113	113		113
WELD				254	254		254
TOTAL TRACK & SURFACE			954	3041	3995		3995
LABOR/MATERIAL EXPENSE			344643	209256			
RECOLLECTIBLE/UPRR EXPENSE					553899	0	
ESTIMATED PROJECT COST							553899

THE ABOVE FIGURES ARE ESTIMATES ONLY AND SUBJECT TO FLUCTUATION. IN THE EVENT OF

Exhibit B-1
Railroad's Signal Material Estimate

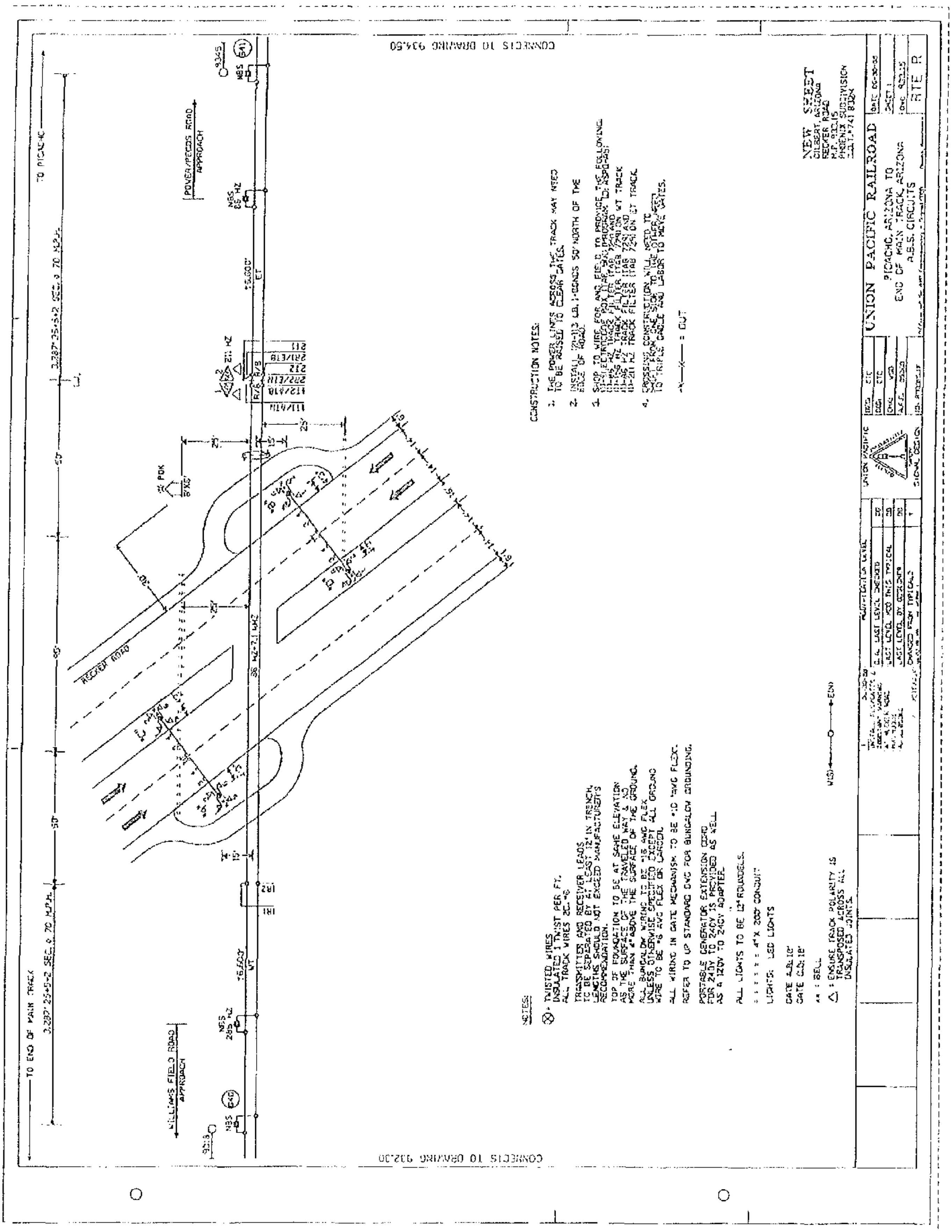


Exhibit B-1
Railroad's Signal Material Estimate

EXHIBIT C

To Supplemental Agreement
(Existing Public Road Crossing Improvement)

Cover Sheet for the Form of
Contractor's Right of Entry Agreement

January 26, 2009

UPRR Folder No.: 2538-74

To the Contractor:

Before Union Pacific Railroad Company can permit you to perform work on its property for the reconstruction and widening of the existing Recker Road at-grade public road crossing, it will be necessary for you to complete and execute two originals of the enclosed *Contractor's Right of Entry Agreement*. Please:

1. Fill in the complete legal name of the contractor in the space provided on Page 1 of the Contractor's Right of Entry Agreement. If a corporation, give the state of incorporation. If a partnership, give the names of all partners.
2. Fill in the date construction will begin and be completed in Article 5, Paragraph A.
3. Fill in the name of the contractor in the space provided in the signature block at the end of the Contractor's Right of Entry Agreement. If the contractor is a corporation, the person signing on its behalf must be an elected corporate officer.
4. Execute and return all copies of the Contractor's Right of Entry Agreement together with your Certificate of Insurance as required in Exhibit B, in the attached, self-addressed envelope.
5. Include a check made payable to the Union Pacific Railroad Company in the amount of **$500.00**. If you require formal billing, you may consider this letter as a formal bill. In compliance with the Internal Revenue Services' new policy regarding their Form 1099, I certify that 94-6001323 is the Railroad Company's correct Federal Taxpayer Identification Number and that Union Pacific Railroad Company is doing business as a corporation.

Under Exhibit B of the enclosed Contractor's Right of Entry Agreement, you are required to procure Railroad Protective Liability Insurance (RPLI) for the duration of this project. As a service to you, Union Pacific is making this coverage available to you. If you decide that acquiring this coverage from the Railroad is of benefit to you, please contact Mr. Mike McGrade of Marsh USA @ 800-729-7001, e-mail: *william.j.smith@marsh.com*.

This agreement will not be accepted by the Railroad Company until you have returned **all** of the following to the undersigned at Union Pacific Railroad Company:

1. Executed, unaltered duplicate original counterparts of the Contractor's Right of Entry Agreement;
2. Your check in the amount of $500.00 to pay the required balance due of the required Contractor's Right of Entry fee. (The Folder Number and the name "Paul G. Farrell" should be written on the check to insure proper credit). If you require formal billing, you may consider this letter as a formal bill;
3. Copies of all of your **up-to-date** General Liability, Auto Liability & Workman's Compensation Insurance Certificates *(yours and all contractors')*, naming Union Pacific Railroad Company as additional insured;

Real Estate Department
UNION PACIFIC RAILROAD COMPANY
1400 Douglas Street, MS 1690
Omaha, Nebraska 68179-1690
fax: 402.501.0340

4. Copy of your **up-to-date** Railroad Protective Liability Insurance Certificate *(yours and all contractors')*, naming Union Pacific Railroad Company as additional insured.

RETURN ALL OF THESE REQUIRED ITEMS TOGETHER IN ONE ENVELOPE.
DO NOT MAIL ANY ITEM SEPARATELY.

If you have any questions concerning this agreement, please contact me as noted below. Have a safe day!

Paul G. Farrell
Senior Manager Contracts
Phone: (402) 544-8620
e-mail: *pgfarrell@up.com*

Real Estate Department
UNION PACIFIC RAILROAD COMPANY
1400 Douglas Street, MS 1690
Omaha, Nebraska 68179-1690
fax. 402.501.0340

BUILDING AMERICA®

UPRR Folder No.: 2538-74

UPRR Audit No.: _____

CONTRACTOR'S RIGHT OF ENTRY AGREEMENT

THIS AGREEMENT is made and entered into as of the _____ day of _____, 200___, by and between **UNION PACIFIC RAILROAD COMPANY**, a Delaware corporation ("Railroad"); and

_____,
(NAME OF CONTRACTOR)

a _____ corporation ("Contractor").
(State of Corporation)

RECITALS:

Contractor has been hired by the *Town of Gilbert* to perform work relating to the reconstruction and widening of the existing Recker Road at-grade public road crossing (the "work"), with all or a portion of such work to be performed on property of Railroad in the vicinity of the Railroad's Mile Post 933.15 on the Railroad's Phoenix Subdivision in Gilbert, Maricopa County, Arizona, as such location is in the general location shown on the Railroad Location Print marked **Exhibit A**, and as specified on the Detailed Print marked **Exhibit A-1**, each attached hereto and hereby made a part hereof, which work is the subject of a contract dated _____ between Railroad and the Town of Gilbert.
(Date of Contract)

The Railroad is willing to permit the Contractor to perform the work described above at the location described above subject to the terms and conditions contained in this Agreement

AGREEMENT:

NOW, THEREFORE, it is mutually agreed by and between Railroad and Contractor, as follows:

ARTICLE 1 - DEFINITION OF CONTRACTOR.

For purposes of this Agreement, all references in this agreement to Contractor shall include Contractor's contractors, subcontractors, officers, agents and employees, and others acting under its or their authority.

ARTICLE 2 - RIGHT GRANTED; PURPOSE.

Railroad hereby grants to Contractor the right, during the term hereinafter stated and upon and subject to each and all of the terms, provisions and conditions herein contained, to enter upon and have ingress to and egress from the property described in the Recitals for the purpose of performing the work described in the Recitals above. The right herein granted to Contractor is limited to those

portions of Railroad's property specifically described herein, or as designated by the Railroad Representative named in Article 4.

ARTICLE 3 - TERMS AND CONDITIONS CONTAINED IN EXHIBITS B, C & D.

The terms and conditions contained in **Exhibit B, Exhibit C** and **Exhibit D**, attached hereto, are hereby made a part of this Agreement.

ARTICLE 4 - ALL EXPENSES TO BE BORNE BY CONTRACTOR; RAILROAD REPRESENTATIVE.

A. Contractor shall bear any and all costs and expenses associated with any work performed by Contractor, or any costs or expenses incurred by Railroad relating to this Agreement.

B. Contractor shall coordinate all of its work with the following Railroad representative or his or her duly authorized representative (the "Railroad Representative"):

Mike Battista
Manager Track Maintenance
Union Pacific Railroad Company
1255 South Campbell Avenue
Tucson, AZ 85713
Phone: 602-322-2506
Fax: 602-322-2515

John Clark
Manager Signal Maintenance
Union Pacific Railroad Company
301 Gila Street
Yuma, AZ 85364
Phone: 925-343-4563
Fax: 928-343-4558

C. Contractor, at its own expense, shall adequately police and supervise all work to be performed by Contractor and shall ensure that such work is performed in a safe manner as set forth in Section 7 of **Exhibit B**. The responsibility of Contractor for safe conduct and adequate policing and supervision of Contractor's work shall not be lessened or otherwise affected by Railroad's approval of plans and specifications involving the work, or by Railroad's collaboration in performance of any work, or by the presence at the work site of a Railroad Representative, or by compliance by Contractor with any requests or recommendations made by Railroad Representative.

ARTICLE 5 - TERM; TERMINATION.

A. The grant of right herein made to Contractor shall commence on the date of this Agreement, and continue until _____, unless sooner terminated as herein provided, or
(Expiration Date)
at such time as Contractor has completed its work on Railroad's property, whichever is earlier. Contractor agrees to notify the Railroad Representative in writing when it has completed its work on Railroad's property.

B. This Agreement may be terminated by either party on ten (10) days written notice to the other party.

ARTICLE 6 - CERTIFICATE OF INSURANCE.

A. Before commencing any work, Contractor will provide Railroad with the (i) insurance binders, policies, certificates and endorsements set forth in **Exhibit C** of this Agreement, and (ii) the

insurance endorsements obtained by each subcontractor as required under Section 12 of **Exhibit B** of this Agreement.

B. All insurance correspondence, binders, policies, certificates and endorsements shall be sent to:

Union Pacific Railroad Company
Real Estate Department
1400 Douglas Street, MS 1690
Omaha, NE 68179-1690
UPRR Folder No.: 2538-74

ARTICLE 7 - DISMISSAL OF CONTRACTOR'S EMPLOYEE.

At the request of Railroad, Contractor shall remove from Railroad's property any employee of Contractor who fails to conform to the instructions of the Railroad Representative in connection with the work on Railroad's property, and any right of Contractor shall be suspended until such removal has occurred. Contractor shall indemnify Railroad against any claims arising from the removal of any such employee from Railroad's property.

ARTICLE 8 - ADMINISTRATIVE FEE.

Upon the execution and delivery of this Agreement, Contractor shall pay to Railroad **FIVE HUNDRED DOLLARS ($500.00)** as reimbursement for clerical, administrative and handling expenses in connection with the processing of this Agreement.

ARTICLE 9 - CROSSINGS.

No additional vehicular crossings (including temporary haul roads) or pedestrian crossings over Railroad's trackage shall be installed or used by Contractor without the prior written permission of Railroad.

ARTICLE 10 - EXPLOSIVES.

Explosives or other highly flammable substances shall not be stored on Railroad's property without the prior written approval of Railroad.

IN WITNESS WHEREOF, the parties hereto have duly executed this agreement in duplicate as of the date first herein written.

UNION PACIFIC RAILROAD COMPANY
(Federal Tax ID #94-6001323)

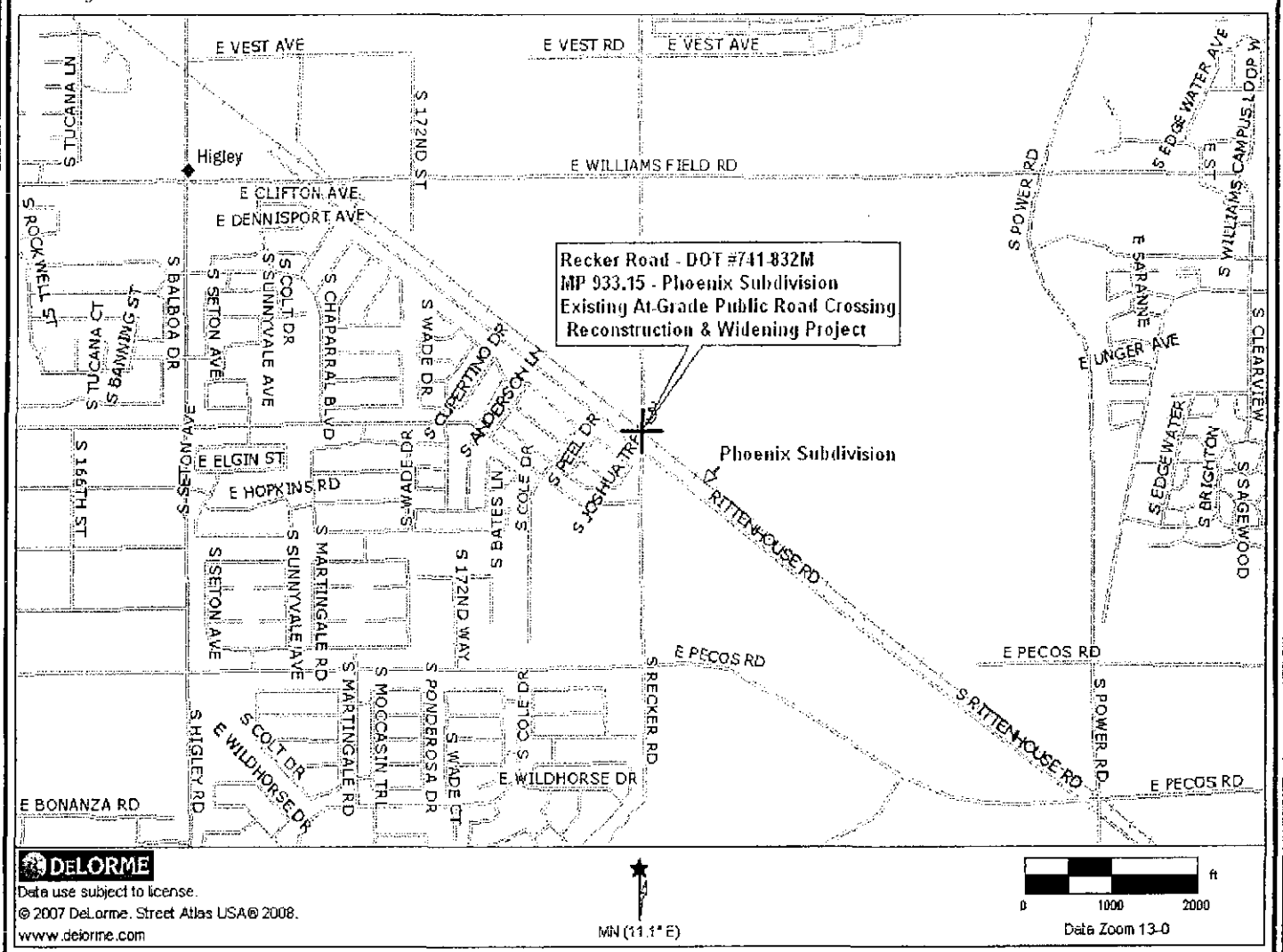
By:_____
PAUL G. FARRELL
Senior Manager Contracts

_____
(Name of Contractor)

By_____

Title:_____

RAILROAD LOCATION PRINT
ACCOMPANYING A
CONTRACTOR'S RIGHT OF ENTRY AGREEMENT



RAILROAD WORK TO BE PERFORMED:

1. Re-lay 320-feet of track; Install 144-feet of concrete road crossing panels; Install 100 cross ties; Install 2 carloads of ballast; and other track & surface materials.
2. Install automatic flashing light crossing signals with gates; Relocate existing gates, signals, conduits and other signal facilities; and other signal materials.
3. Engineering Design Review & Flagging.

BRIEF DESCRIPTION:

A parcel of land located in the East ½ of Section 35 and the SW¼ of Section 36, Township 1 South, Range 6 East of the Gila & Salt River Meridian, in Maricopa County, Arizona.

EXHIBIT "A"

UNION PACIFIC RAILROAD COMPANY

PHOENIX SUBDIVISION
MILE POST 933.15
GPS: N 33° 17.9740', W 111° 42.2248'
GILBERT, MARICOPA CO., AZ.

To accompany Contractor's Right of Entry Agreement with

_____
(Name of Contractor)

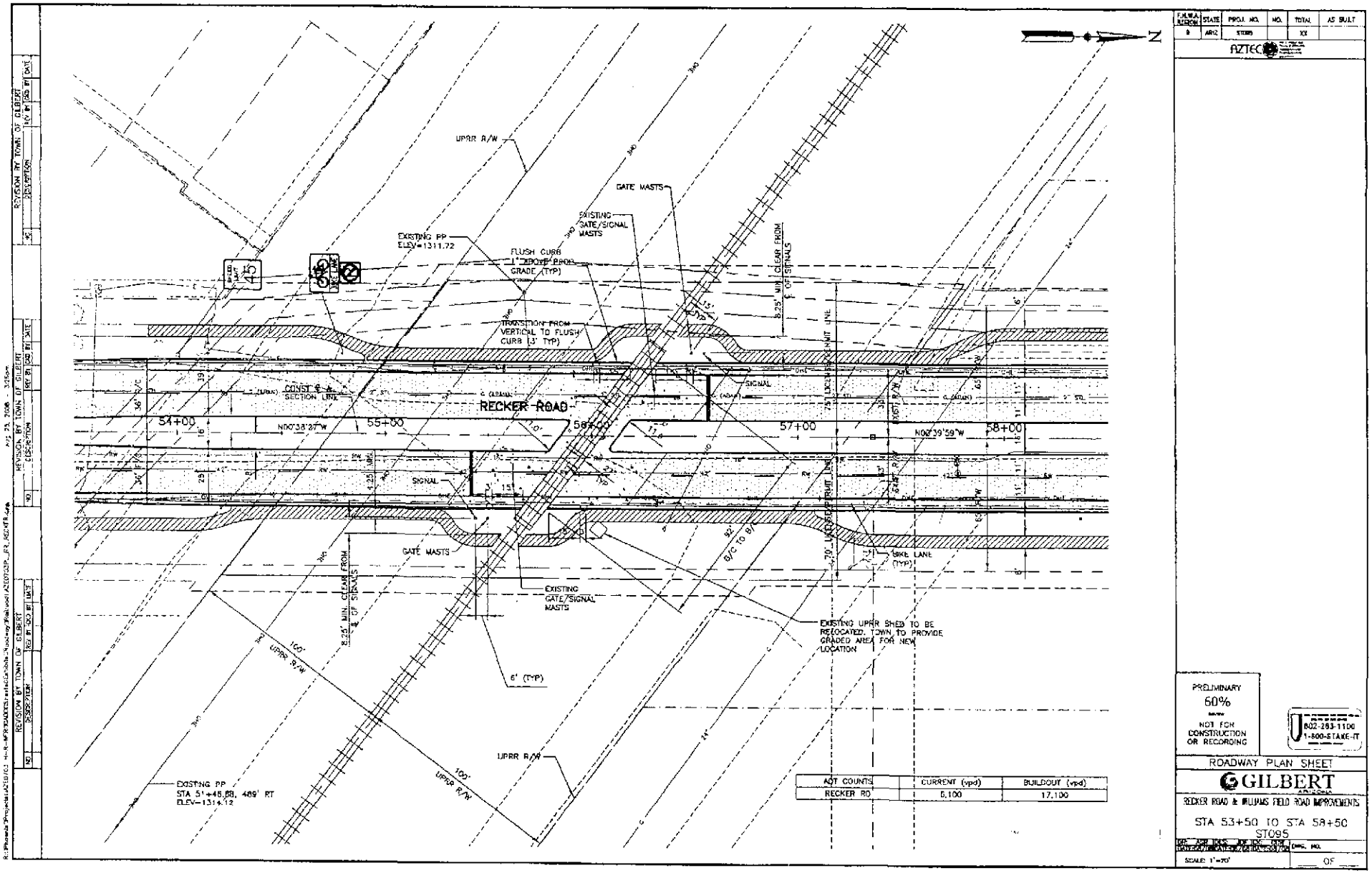
for an existing at-grade public road crossing reconstruction, widening and improvement project.

Folder No. 2538-74 Date: January 26, 2009

WARNING

IN ALL OCCASIONS, U.P. COMMUNICATIONS DEPARTMENT MUST BE CONTACTED IN ADVANCE OF ANY WORK TO DETERMINE EXISTENCE AND LOCATION OF FIBER OPTIC CABLE
PHONE: 1-(800) 336-9193

Exhibit A-1
Detailed Print



REVISION BY TOWN OF GILBERT			
NO.	DESCRIPTION	REV. BY	DSD BY

REVISION BY TOWN OF GILBERT			
NO.	DESCRIPTION	REV. BY	DSD BY

REVISION BY TOWN OF GILBERT			
NO.	DESCRIPTION	REV. BY	DSD BY

F.H.W.A. REGION	STATE	PROJ. NO.	NO.	TOTAL	AS BUILT
9	ARIZ.	STP095		XX	

AZTEC

PRELIMINARY
60%
NOT FOR CONSTRUCTION OR RECORDING

BLUE STAKE, INC.
602-263-1100
1-800-STAKE-IT

ROADWAY PLAN SHEET

GILBERT ARIZONA

RECKER ROAD & WILLIAMS FIELD ROAD IMPROVEMENTS

STA 53+50 TO STA 58+50

STP095

DES.	DRN.	CK.	DATE	DWG. NO.

SCALE: 1"=20'

SHT. OF

EXHIBIT B

TO CONTRACTOR'S RIGHT OF ENTRY AGREEMENT

TERMS AND CONDITIONS

Section 1. NOTICE OF COMMENCEMENT OF WORK - FLAGGING.

A. Contractor agrees to notify the Railroad Representative at least ten (10) working days in advance of Contractor commencing its work and at least ten (10) working days in advance of proposed performance of any work by Contractor in which any person or equipment will be within twenty-five (25) feet of any track, or will be near enough to any track that any equipment extension (such as, but not limited to, a crane boom) will reach to within twenty-five (25) feet of any track. No work of any kind shall be performed, and no person, equipment, machinery, tool(s), material(s), vehicle(s), or thing(s) shall be located, operated, placed, or stored within twenty-five (25) feet of any of Railroad's track(s) at any time, for any reason, unless and until a Railroad flagman is provided to watch for trains. Upon receipt of such ten (10)-day notice, the Railroad Representative will determine and inform Contractor whether a flagman need be present and whether Contractor needs to implement any special protective or safety measures. If flagging or other special protective or safety measures are performed by Railroad, Railroad will bill Contractor for such expenses incurred by Railroad, unless Railroad and a federal, state or local governmental entity have agreed that Railroad is to bill such expenses to the federal, state or local governmental entity. If Railroad will be sending the *bills to Contractor*, Contractor shall pay such bills within thirty (30) days of Contractor's receipt of billing. If Railroad performs any flagging, or other special protective or safety measures are performed by Railroad, Contractor agrees that Contractor is not relieved of any of its responsibilities or liabilities set forth in this Agreement.

B. The rate of pay per hour for each flagman will be the prevailing hourly rate in effect for an eight-hour day for the class of flagmen used during regularly assigned hours and overtime in accordance with Labor Agreements and Schedules in effect at the time the work is performed. In addition to the cost of such labor, a composite charge for vacation, holiday, health and welfare, supplemental sickness, Railroad Retirement and unemployment compensation, supplemental pension, Employees Liability and Property Damage and Administration will be included, computed on actual payroll. The composite charge will be the prevailing composite charge in effect at the time the work is performed. One and one-half times the current hourly rate is paid for overtime, Saturdays and Sundays, and two and one-half times current hourly rate for holidays. Wage rates are subject to change, at any time, by law or by agreement between Railroad and its employees, and may be retroactive as a result of negotiations or a ruling of an authorized governmental agency. Additional charges on labor are also subject to change. If the wage rate or additional charges are changed, Contractor (or the governmental entity, as applicable) shall pay on the basis of the new rates and charges.

C. Reimbursement to Railroad will be required covering the full eight-hour day during which any flagman is furnished, unless the flagman can be assigned to other Railroad work during a portion of such day, in which event reimbursement will not be required for the portion of the day during which the flagman is engaged in other Railroad work. Reimbursement will also be required for any day not actually worked by the flagman following the flagman's assignment to work on the project for which Railroad is required to pay the flagman and which could not reasonably be avoided by Railroad by assignment of such flagman to other work, even though Contractor may not be working during such time. When it becomes necessary for Railroad to bulletin and assign an employee to a flagging position in compliance with union collective bargaining agreements, Contractor must provide Railroad a minimum of five (5) days notice prior to the cessation of the need for a flagman. If five (5) days notice of cessation is not given, Contractor will still be required to pay flagging charges for the five (5) day notice period required by union agreement to be given to the employee, even though flagging is not required for that period. An additional ten (10) days notice must then be given to Railroad if flagging services are needed again after such five day cessation notice has been given to Railroad.

Section 2. LIMITATION AND SUBORDINATION OF RIGHTS GRANTED

A. The foregoing grant of right is subject and subordinate to the prior and continuing right and obligation of the Railroad to use and maintain its entire property including the right and power of Railroad to construct, maintain, repair, renew, use, operate, change, modify or relocate railroad tracks, roadways, signal, communication, fiber optics, or other wirelines, pipelines and other facilities upon, along or across any or all parts of its property, all or any of which may be freely done at any time or times by Railroad without liability to Contractor or to any other party for compensation or damages.

B. The foregoing grant is also subject to all outstanding superior rights (including those in favor of licensees and lessees of Railroad's property, and others) and the right of Railroad to renew and extend the same, and is made without covenant of title or for quiet enjoyment.

Section 3. NO INTERFERENCE WITH OPERATIONS OF RAILROAD AND ITS TENANTS.

A. Contractor shall conduct its operations so as not to interfere with the continuous and uninterrupted use and operation of the railroad tracks and property of Railroad, including without limitation, the operations of Railroad's lessees, licensees or others, unless specifically authorized in advance by the Railroad Representative. Nothing shall be done or permitted to be done by Contractor at any time that would in any manner impair the safety of such operations. When not in use, Contractor's machinery

and materials shall be kept at least fifty (50) feet from the centerline of Railroad's nearest track, and there shall be no vehicular crossings of Railroads tracks except at existing open public crossings.

B. Operations of Railroad and work performed by Railroad personnel and delays in the work to be performed by Contractor caused by such railroad operations and work are expected by Contractor, and Contractor agrees that Railroad shall have no liability to Contractor, or any other person or entity for any such delays. The Contractor shall coordinate its activities with those of Railroad and third parties so as to avoid interference with railroad operations. The safe operation of Railroad train movements and other activities by Railroad takes precedence over any work to be performed by Contractor.

Section 4. LIENS.

Contractor shall pay in full all persons who perform labor or provide materials for the work to be performed by Contractor. Contractor shall not create, permit or suffer any mechanic's or materialmen's liens of any kind or nature to be created or enforced against any property of Railroad for any such work performed. Contractor shall indemnify and hold harmless Railroad from and against any and all liens, claims, demands, costs or expenses of whatsoever nature in any way connected with or growing out of such work done, labor performed, or materials furnished. If Contractor fails to promptly cause any lien to be released of record, Railroad may, at its election, discharge the lien or claim of lien at Contractor's expense.

Section 5. PROTECTION OF FIBER OPTIC CABLE SYSTEMS.

A. Fiber optic cable systems may be buried on Railroad's property. Protection of the fiber optic cable systems is of extreme importance since any break could disrupt service to users resulting in business interruption and loss of revenue and profits. Contractor shall telephone Railroad during normal business hours (7:00 a.m. to 9:00 p.m. Central Time, Monday through Friday, except holidays) at 1-800-336-9193 (also a 24-hour, 7-day number for emergency calls) to determine if fiber optic cable is buried anywhere on Railroad's property to be used by Contractor. If it is, Contractor will telephone the telecommunications company(ies) involved, make arrangements for a cable locator and, if applicable, for relocation or other protection of the fiber optic cable. Contractor shall not commence any work until all such protection or relocation (if applicable) has been accomplished.

B. In addition to other indemnity provisions in this Agreement, Contractor shall indemnify, defend and hold Railroad harmless from and against all costs, liability and expense whatsoever (including, without limitation, attorneys' fees, court costs and expenses) arising out of any act or omission of Contractor, its agents and/or employees, that causes or contributes to (1) any damage to or destruction of any telecommunications system on Railroad's property, and/or (2) any injury to or death of any person employed by or on behalf of any telecommunications company, and/or its contractor, agents and/or employees, on Railroad's property. Contractor shall not have or seek recourse against Railroad for any claim or cause of action for alleged loss of profits or revenue or loss of service or other consequential damage to a telecommunication company using Railroad's property or a customer or user of services of the fiber optic cable on Railroad's property.

Section 6. PERMITS - COMPLIANCE WITH LAWS.

In the prosecution of the work covered by this Agreement, Contractor shall secure any and all necessary permits and shall comply with all applicable federal, state and local laws, regulations and enactments affecting the work including, without limitation, all applicable Federal Railroad Administration regulations.

Section 7. SAFETY.

A. Safety of personnel, property, rail operations and the public is of paramount importance in the prosecution of the work performed by Contractor. Contractor shall be responsible for initiating, maintaining and supervising all safety, operations and programs in connection with the work. Contractor shall at a minimum comply with Railroad's safety standards listed in **Exhibit C**, hereto attached, to ensure uniformity with the safety standards followed by Railroad's own forces. As a part of Contractor's safety responsibilities, Contractor shall notify Railroad if Contractor determines that any of Railroad's safety standards are contrary to good safety practices. Contractor shall furnish copies of **Exhibit C** to each of its employees before they enter the job site.

B. Without limitation of the provisions of paragraph A above, Contractor shall keep the job site free from safety and health hazards and ensure that its employees are competent and adequately trained in all safety and health aspects of the job.

C. Contractor shall have proper first aid supplies available on the job site so that prompt first aid services may be provided to any person injured on the job site. Contractor shall promptly notify Railroad of any U.S. Occupational Safety and Health Administration reportable injuries. Contractor shall have a nondelegable duty to control its employees while they are on the job site or any other property of Railroad, and to be certain they do not use, be under the influence of, or have in their possession any alcoholic beverage, drug or other substance that may inhibit the safe performance of any work.

D. If and when requested by Railroad, Contractor shall deliver to Railroad a copy of Contractor's safety plan for conducting the work (the "Safety Plan"). Railroad shall have the right, but not the obligation, to require Contractor to correct any deficiencies in the Safety Plan. The terms of this Agreement shall control if there are any inconsistencies between this Agreement and the Safety Plan.

Section 8. INDEMNITY.

A. To the extent not prohibited by applicable statute, Contractor shall indemnify, defend and hold harmless Railroad, its affiliates, and its and their officers, agents and employees ("Indemnified Parties") from and against any and all loss, damage, injury, liability, claim, demand, cost or expense (including, without limitation, attorney's, consultant's and expert's fees, and court costs), fine or penalty (collectively, "loss") incurred by any person (including, without limitation, any indemnified party, contractor, or any employee of contractor or of any indemnified party) arising out of or in any manner connected with (i) any work performed by Contractor, or (ii) any act or omission of Contractor, its officers, agents or employees, or (iii) any breach of this Agreement by Contractor.

B. The right to indemnity under this Section 8 shall accrue upon occurrence of the event giving rise to the loss, and shall apply regardless of any negligence or strict liability of any indemnified party, except where the loss is caused by the sole active negligence of an indemnified party as established by the final judgment of a court of competent jurisdiction. The sole active negligence of any indemnified party shall not bar the recovery of any other indemnified party.

C. Contractor expressly and specifically assumes potential liability under this Section 8 for claims or actions brought by Contractor's own employees. Contractor waives any immunity it may have under worker's compensation or industrial insurance acts to indemnify Railroad under this Section 8. Contractor acknowledges that this waiver was mutually negotiated by the parties hereto.

D. No court or jury findings in any employee's suit pursuant to any worker's compensation act or the federal employers' liability act against a party to this Agreement may be relied upon or used by Contractor in any attempt to assert liability against Railroad.

E. The provisions of this Section 8 shall survive the completion of any work performed by Contractor or the termination or expiration of this Agreement. In no event shall this Section 8 or any other provision of this Agreement be deemed to limit any liability Contractor may have to any indemnified party by statute or under common law.

Section 9. RESTORATION OF PROPERTY.

In the event Railroad authorizes Contractor to take down any fence of Railroad or in any manner move or disturb any of the other property of Railroad in connection with the work to be performed by Contractor, then in that event Contractor shall, as soon as possible and at Contractor's sole expense, restore such fence and other property to the same condition as the same were in before such fence was taken down or such other property was moved or disturbed. Contractor shall remove all of Contractor's tools, equipment, rubbish and other materials from Railroad's property promptly upon completion of the work, restoring Railroad's property to the same state and condition as when Contractor entered thereon.

Section 10. WAIVER OF DEFAULT.

Waiver by Railroad of any breach or default of any condition, covenant or agreement herein contained to be kept, observed and performed by Contractor shall in no way impair the right of Railroad to avail itself of any remedy for any subsequent breach or default.

Section 11. MODIFICATION - ENTIRE AGREEMENT.

No modification of this Agreement shall be effective unless made in writing and signed by Contractor and Railroad. This Agreement and the exhibits attached hereto and made a part hereof constitute the entire understanding between Contractor and Railroad and cancel and supersede any prior negotiations, understandings or agreements, whether written or oral, with respect to the work to be performed by Contractor.

Section 12. ASSIGNMENT - SUBCONTRACTING.

Contractor shall not assign or subcontract this Agreement, or any interest therein, without the written consent of the Railroad. Contractor shall be responsible for the acts and omissions of all subcontractors. Before Contractor commences any work, the Contractor shall, except to the extent prohibited by law; (1) require each of its subcontractors to include the Contractor as "Additional Insured" in the subcontractor's Commercial General Liability policy and Business Automobile policies with respect to all liabilities arising out of the subcontractor's performance of work on behalf of the Contractor by endorsing these policies with ISO Additional Insured Endorsements CG 20 26, and CA 20 48 (or substitute forms providing equivalent coverage; (2) require each of its subcontractors to endorse their Commercial General Liability Policy with "Contractual Liability Railroads" ISO Form CG 24 17 10 01 (or a substitute form providing equivalent coverage) for the job site; and (3) require each of its subcontractors to endorse their Business Automobile Policy with "Coverage For Certain Operations In Connection With Railroads" ISO Form CA 20 70 10 01 (or a substitute form providing equivalent coverage) for the job site.

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EXHIBIT C

TO CONTRACTOR'S RIGHT OF ENTRY AGREEMENT

INSURANCE PROVISIONS

Contractor shall, at its sole cost and expense, procure and maintain during the course of the Project and until all Project work on Railroad's property has been completed and the Contractor has removed all equipment and materials from Railroad's property and has cleaned and restored Railroad's property to Railroad's satisfaction, the following insurance coverage:

A. **Commercial General Liability Insurance**. Commercial general liability (CGL) with a limit of not less than $5,000,000 each occurrence and an aggregate limit of not less than $10,000,000. CGL insurance must be written on ISO occurrence form CG 00 01 12 04 (or a substitute form providing equivalent coverage).

The policy must also contain the following endorsement, which must be stated on the certificate of insurance:

- Contractual Liability Railroads ISO form CG 24 17 10 01 (or a substitute form providing equivalent coverage) showing "Union Pacific Railroad Company Property" as the Designated Job Site, and
- Designated Construction Project(s) General Aggregate Limit ISO Form CG 25 03 03 97 (or a substitute form providing equivalent coverage) showing the project on the form schedule.

B. **Business Automobile Coverage Insurance**. Business auto coverage written on ISO form CA 00 01 10 01 (or a substitute form providing equivalent liability coverage) with a combined single limit of not less $5,000,000 for each accident and coverage must include liability arising out of any auto (including owned, hired and non-owned autos).

The policy must contain the following endorsements, which must be stated on the certificate of insurance:

- Coverage For Certain Operations In Connection With Railroads ISO form CA 20 70 10 01 (or a substitute form providing equivalent coverage) showing "Union Pacific Property" as the Designated Job Site.
- Motor Carrier Act Endorsement - Hazardous materials clean up (MCS-90) if required by law.

C. **Workers' Compensation and Employers' Liability Insurance**. Coverage must include but not be limited to:

- Contractor's statutory liability under the workers' compensation laws of the state where the work is being performed.
- Employers' Liability (Part B) with limits of at least $500,000 each accident, $500,000 disease policy limit $500,000 each employee.

If Contractor is self-insured, evidence of state approval and excess workers compensation coverage must be provided. Coverage must include liability arising out of the U. S. Longshoremen's and Harbor Workers' Act, the Jones Act, and the Outer Continental Shelf Land Act, if applicable.

The policy must contain the following endorsement, which must be stated on the certificate of insurance:

- Alternate Employer endorsement ISO form WC 00 03 01 A (or a substitute form providing equivalent coverage) showing Railroad in the schedule as the alternate employer (or a substitute form providing equivalent coverage).

D. **Railroad Protective Liability Insurance**. Contractor must maintain Railroad Protective Liability insurance written on ISO occurrence form CG 00 35 12 04 (or a substitute form providing equivalent coverage) on behalf of Railroad as named insured, with a limit of not less than $2,000,000 per occurrence and an aggregate of $6,000,000. A binder stating the policy is in place must be submitted to Railroad before the work may be commenced and until the original policy is forwarded to Railroad.

E. **Umbrella or Excess Insurance**. If Contractor utilizes umbrella or excess policies, these policies must "follow form" and afford no less coverage than the primary policy.

F. **Pollution Liability Insurance**. Pollution liability coverage must be written on ISO form Pollution Liability Coverage Form Designated Sites CG 00 39 12 04 (or a substitute form providing equivalent liability coverage), with limits of at least $5,000,000 per occurrence and an aggregate limit of $10,000,000.

If the scope of work as defined in this Agreement includes the disposal of any hazardous or non-hazardous materials from the job site, Contractor must furnish to Railroad evidence of pollution legal liability insurance maintained by the disposal site operator for losses arising from the insured facility accepting the materials, with coverage in minimum amounts of $1,000,000 per loss, and an annual aggregate of $2,000,000.

Other Requirements

G. All policy(ies) required above (except worker's compensation and employers liability) must include Railroad as "Additional Insured" using ISO Additional Insured Endorsements CG 20 26, and CA 20 48 (or substitute forms providing equivalent coverage). The coverage provided to Railroad as additional insured shall, to the extent provided under ISO Additional Insured Endorsement CG 20 26, and CA 20 48 provide coverage for Railroad's negligence whether sole or partial, active or passive, and shall not be limited by Contractor's liability under the indemnity provisions of this Agreement.

H. Punitive damages exclusion, if any, must be deleted (and the deletion indicated on the certificate of insurance), unless the law governing this Agreement prohibits all punitive damages that might arise under this Agreement.

I. Contractor waives all rights of recovery, and its insurers also waive all rights of subrogation of damages against Railroad and its agents, officers, directors and employees. This waiver must be stated on the certificate of insurance.

J. Prior to commencing the work, Contractor shall furnish Railroad with a certificate(s) of insurance, executed by a duly authorized representative of each insurer, showing compliance with the insurance requirements in this Agreement.

K. All insurance policies must be written by a reputable insurance company acceptable to Railroad or with a current Best's Insurance Guide Rating of A- and Class VII or better, and authorized to do business in the state where the work is being performed.

L. The fact that insurance is obtained by Contractor or by Railroad on behalf of Contractor will not be deemed to release or diminish the liability of Contractor, including, without limitation, liability under the indemnity provisions of this Agreement. Damages recoverable by Railroad from Contractor or any third party will not be limited by the amount of the required insurance coverage.

EXHIBIT D

TO CONTRACTOR'S RIGHT OF ENTRY AGREEMENT

MINIMUM SAFETY REQUIREMENTS

The term "employees" as used herein refer to all employees of Contractor as well as all employees of any subcontractor or agent of Contractor.

I. Clothing

A. All employees of Contractor will be suitably dressed to perform their duties safely and in a manner that will not interfere with their vision, hearing, or free use of their hands or feet.

Specifically, Contractor's employees must wear:

(i) Waist-length shirts with sleeves.
(ii) Trousers that cover the entire leg. If flare-legged trousers are worn, the trouser bottoms must be tied to prevent catching.
(iii) Footwear that covers their ankles and has a defined heel. Employees working on bridges are required to wear safety-toed footwear that conforms to the American National Standards Institute (ANSI) and FRA footwear requirements.

B. Employees shall not wear boots (other than work boots), sandals, canvas-type shoes, or other shoes that have thin soles or heels that are higher than normal.

C. Employees must not wear loose or ragged clothing, neckties, finger rings, or other loose jewelry while operating or working on machinery.

II. Personal Protective Equipment

Contractor shall require its employees to wear personal protective equipment as specified by Railroad rules, regulations, or recommended or requested by the Railroad Representative.

(i) Hard hat that meets the American National Standard (ANSI) Z89.1 – latest revision. Hard hats should be affixed with Contractor's company logo or name.
(ii) Eye protection that meets American National Standard (ANSI) for occupational and educational eye and face protection, Z87.1 – latest revision. Additional eye protection must be provided to meet specific job situations such as welding, grinding, etc.
(iii) Hearing protection, which affords enough attenuation to give protection from noise levels that will be occurring on the job site. Hearing protection, in the form of plugs or muffs, must be worn when employees are within:

- 100 feet of a locomotive or roadway/work equipment
- 15 feet of power operated tools
- 150 feet of jet blowers or pile drivers
- 150 feet of retarders in use (when within 10 feet, employees must wear dual ear protection – plugs and muffs)

(iv) Other types of personal protective equipment, such as respirators, fall protection equipment, and face shields, must be worn as recommended or requested by the Railroad Representative.

III. On Track Safety

Contractor is responsible for compliance with the Federal Railroad Administration's Roadway Worker Protection regulations – 49CFR214, Subpart C and Railroad's On-Track Safety rules. Under 49CFR214, Subpart C, railroad contractors are responsible for the training of their employees on such regulations. In addition to the instructions contained in Roadway Worker Protection regulations, all employees must:

(i) Maintain a distance of twenty-five (25) feet to any track unless the Railroad Representative is present to authorize movements.
(ii) Wear an orange, reflectorized workwear approved by the Railroad Representative.
(iii) Participate in a job briefing that will specify the type of On-Track Safety for the type of work being performed. Contractor must take special note of limits of track authority, which tracks may or may not be fouled, and clearing the track. Contractor will also receive special instructions relating to the work zone around machines and minimum distances between machines while working or traveling.

IV. Equipment

A. It is the responsibility of Contractor to ensure that all equipment is in a safe condition to operate. If, in the opinion of the Railroad Representative, any of Contractor's equipment is unsafe for use, Contractor shall remove such equipment from Railroad's

property. In addition, Contractor must ensure that the operators of all equipment are properly trained and competent in the safe operation of the equipment. In addition, operators must be:

- Familiar and comply with Railroad's rules on lockout/tagout of equipment.
- Trained in and comply with the applicable operating rules if operating any hy-rail equipment on-track.
- *Trained in and comply with the applicable air brake rules if operating any equipment that moves rail cars or any other railbound equipment.*

B. All self-propelled equipment must be equipped with a first-aid kit, fire extinguisher, and audible back-up warning device.

C. Unless otherwise authorized by the Railroad Representative, all equipment must be parked a minimum of twenty-five (25) feet from any track. Before leaving any equipment unattended, the operator must stop the engine and properly secure the equipment against movement.

D. Cranes must be equipped with three orange cones that will be used to mark the working area of the crane and the minimum clearances to overhead powerlines.

V. General Safety Requirements

A. Contractor shall ensure that all waste is properly disposed of in accordance with applicable federal and state regulations.

B. Contractor shall ensure that all employees participate in and comply with a job briefing conducted by the Railroad Representative, if applicable. During this briefing, the Railroad Representative will specify safe work procedures, (including On-Track Safety) and the potential hazards of the job. If any employee has any questions or concerns about the work, the employee must voice them during the job briefing. Additional job briefings will be conducted during the work as conditions, work procedures, or personnel change.

C. All track work performed by Contractor *meets the minimum safety requirements* established by the Federal Railroad Administration's Track Safety Standards 49CFR213.

D. All employees comply with the following safety procedures when working around any railroad track:

(i) Always be on the alert for moving equipment. Employees must always expect movement on any track, at any time, in either direction.
(ii) Do not step or walk on the top of the rail, frog, switches, guard rails, or other track components.
(iii) In passing around the ends of standing cars, engines, roadway machines or work equipment, leave at least 20 feet between yourself and the end of the equipment. Do not go between pieces of equipment of the opening is less than one car length (50 feet).
(iv) Avoid walking or standing on a track unless so authorized by the employee in charge.
(v) Before stepping over or crossing tracks, look in both directions first.
(vi) Do not sit on, lie under, or cross between cars except as required in the performance of your duties and only when track and equipment have been protected against movement.

E. All employees must comply with all federal and state regulations concerning workplace safety.

Attachment 4

Cooley Station Traffic Impact Study by TASK Engineering

Cooley Station
Traffic Impact Study

Gilbert, Arizona

Prepared for:
~~Trend Homes~~

August 16, 2006
Revised November 16, 2006

TASK ENGINEERING

3707 North 7th Street Suite 235
Phoenix, Arizona 85014
Phone: 602-277-4224 Fax: 602-277-4228
Email: task@taskeng.net www.taskeng.net

ZN-74

Cooley Station
Traffic Impact Study

Gilbert, Arizona

Prepared for:

Jeff Cooley, Cooley Station
Gilbert, Arizona

By:

TASK Engineering, Inc
3707 North 7th Street, Suite 235
Phoenix, AZ 85014

Phone: (602) 277-4224
Fax: (602) 277-4228

August 16, 2006
REVISED November 16, 2006

2302.04A

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INTRODUCTION

This traffic study analyzes the impacts of the proposed mixed residential/commercial development located south of Ray Road, west of Power Road, east of Wade Road, and north of Pecos Road. This particular area is a portion of a larger development, the Cooley Station Master Planned Community. It is located in Gilbert, Arizona as shown on Figure 1. A previous traffic study in this area addressed the entire master planned community at full buildout conditions. This study analyzes the southern portion of the previous Cooley Master Plan.

The purposes of this study are:

1. To determine the access and egress needs to serve the site,
2. To review driveway, access, and deceleration lane configurations on the adjacent roadway network, and
3. To prepare a traffic impact study for submittal to the Town of Gilbert.

Traffic conditions were analyzed for two scenarios: background traffic in Year 2015, plus full development of Cooley Station, and background traffic in the horizon Year 2025, plus full development of the site. Traffic is analyzed at accesses and on all adjacent roadways within one-half mile.

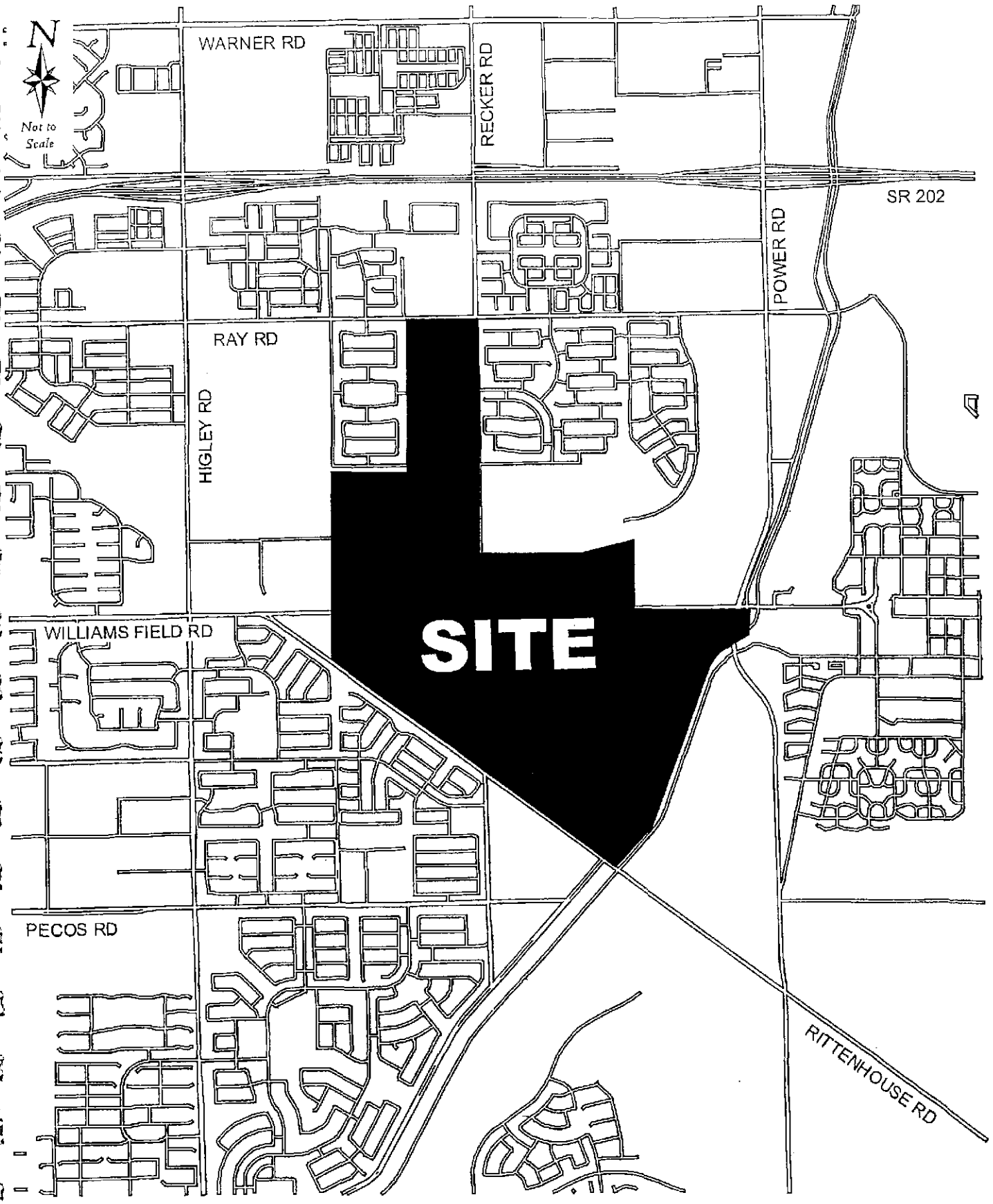
This revised report incorporates comments from the Town of Gilbert dated September 15, 2006. A copy of the comments and a response memorandum are included in Appendix G.

The conclusions of this report are listed in the final section, RECOMMENDATIONS. Appendix A contains summaries of individual capacity analyses. The following sections detail the methodology used to reach the conclusions.

DESCRIPTION OF PROPOSED DEVELOPMENT

The schematic site plan for the proposed development is shown on Figure 2. It is a mixed residential and commercial development with ±8,099 dwelling units, a ±79.74 acre Village Center, a ±40.03 acre Business Park, a ±21 acre K-8 School, and ±21.2 acre shopping center parcel. The residential lots are composed of single family, town homes and apartments. The commercial site is assumed to have general retail stores and is regarded as a shopping center.

There is an existing high school, Higley High School, located on the northeast corner of Pecos Road and Recker Road. There is also an existing shopping center located on the northwest corner of Williams Field Road and Power Road. Arizona State University Polytechnic Campus is also located near the site, east of Power Road. These adjacent sites create additional traffic on the arterial roadways and will interact with the site. Currently the site area and most of the surrounding area a combination of agricultural and residential land uses, with extensive development occurring in the area.



Cooley Station Traffic Impact Study

TASK ENGINEERING

Vicinity Map

Figure 1
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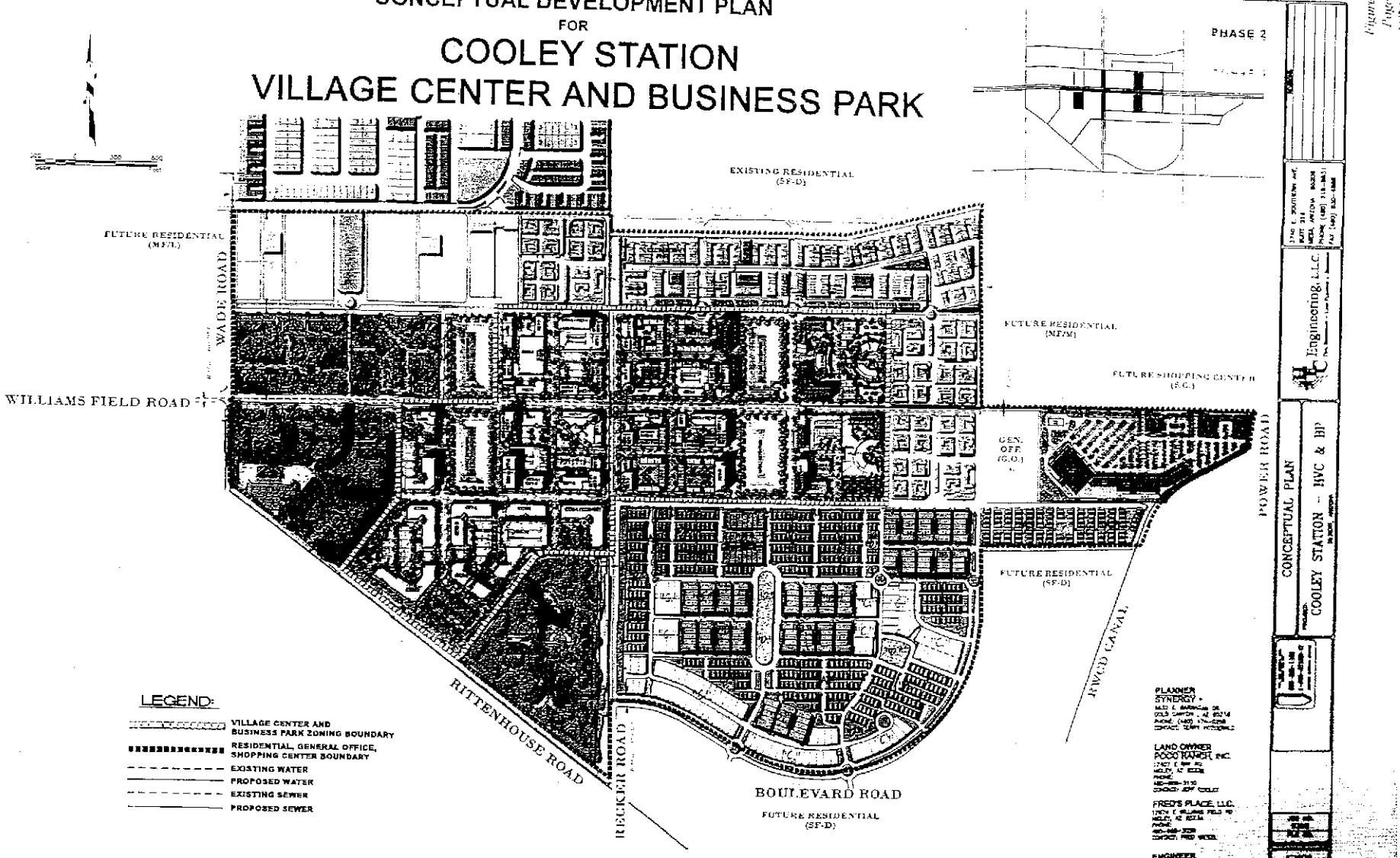
CONCEPTUAL DEVELOPMENT PLAN
FOR
COOLEY STATION
VILLAGE CENTER AND BUSINESS PARK



DESCRIPTION OF ROAD NETWORK

The internal road network is shown on Figure 2.

Power Road serves as the main north-south through street, connecting the site area to the San Tan Freeway. Power Road is currently two lanes in each direction in the vicinity of the site. Power Road has signalized intersection control at Ray Road, Williams Field Road, and Pecos Road.

Recker Road is currently under construction south of Warner Road and between Williams Field Road and Pecos Road. Recker Road has signalized intersection control at Pecos Road, Ray Road and Warner Road, and is four-way STOP sign controlled at Williams Field Road. Although it is an arterial, Recker Road does not have an interchange with the San Tan Freeway, and it does not extend through to Germann Road on the south.

Williams Field Road is currently two lanes in each direction in the vicinity of the site, with a posted speed limit of 45 mph.

East of Recker Road, Ray Road is a five-lane road (two lanes westbound and three lanes eastbound). West of Recker Road, Ray Road is a six-lane road. The posted speed limit on Ray Road is 45 mph.

West of Recker Road, Pecos Road is a five-lane roadway (two lanes eastbound and three lanes westbound). East of Recker Road, Pecos Road is a six-lane roadway. The posted speed limit is 45 mph.

TRIP GENERATION

The first step in estimating traffic from the proposed development is to calculate the total estimated vehicle trips to and from the site on an average weekday after the site has been completely built out. This is called trip generation. Vehicle trips are estimated for a total average weekday and for AM and PM peak hours. *Trip Generation, Seventh Edition,* 2003, and the *Trip Generation Handbook, 2nd Edition, June 2004,* published by the Institute of Transportation Engineers (ITE), were the sources for the trip rates used in this study.

For a large area such as this, some trips will have both their origin and their destination end within the study area. These are referred to as "internal" trips. Other trips will have one end, either origin or destination, in the site and the other end outside the site. These are referred to as "external" trips. The arterial street approaches to the site that these external trips use are referred to as "external stations."

Each trip has two trip ends. The trip Production end represents the end of the trip where the decision to make a trip is made. Generally, this is the home end of a home-based trip. The Attraction end of the trip is generally the end where the trip maker engages in some activity, such as employment, shopping, education or recreation.

Cooley Station

TAZ	Parcel #	TC ID	Parcel Type	Units	Acres	Amount	L.U.C.	Trip Rates					Total				
								Daily Rate	AM Rate	PM Rate	% In AM	% In PM	Weekday	AM In	AM Out	PM In	PM Out
1	1	223	Residential (5-8 DU/Acre)	DUs	79.13	633	210	9.57	0.75	1.01	25%	63%	6,058	119	356	403	237
2	2	226	Residential (5-8 DU/Acre)	DUs	78.84	630	210	9.57	0.75	1.01	25%	63%	6,029	118	354	401	235
3	3	230	Residential (8-14 DU/Acre)	DUs	16.02	224	230	5.86	0.44	0.52	17%	67%	1,313	17	82	78	38
4	4	233	Residential (8-14 DU/Acre)	DUs	13.44	188	230	5.86	0.44	0.52	17%	67%	1,102	14	69	65	32
5	5	238	Residential (14-25 DU/Acre)	DUs	29.78	744	220	6.72	0.51	0.62	20%	65%	5,000	76	304	300	161
6	6A	~	Village Center (Residential)	DUs	10.01	171	220	6.72	0.51	0.62	20%	65%	1,149	17	70	69	37
6	6B	~	Viallge Center (General Office)	TGSF	2.90	94.8377	710	4.49	0.67	0.46	88%	17%	426	56	8	7	36
6	6C	~	Village Center (Commercial)	TGSF	2.20	71.9459	820	76.21	1.79	7.00	61%	48%	5,483	79	50	242	262
	6	241	Sum Village Center Parcel 6	~	~	~	~	~	~	~	~	~	7,058	152	128	318	335
7	7A	~	Village Center (Residential)	DUs	10.01	171	220	6.72	0.51	0.62	20%	65%	1,149	17	70	69	37
7	7B	~	Viallge Center (General Office)	TGSF	2.90	94.8377	710	4.49	0.67	0.46	88%	17%	426	56	8	7	36
7	7C	~	Village Center (Commercial)	TGSF	2.20	71.9459	820	76.21	1.79	7.00	61%	48%	5,483	79	50	242	262
	7	245	Sum Village Center Parcel 7	~	~	~	~	~	~	~	~	~	7,058	152	128	318	335
8	8	248	Residential (14-25 DU/Acre)	DUs	23.94	598	220	6.72	0.51	0.62	20%	65%	4,019	61	244	241	130
9	9	250	Residential (14-25 DU/Acre)	DUs	25.97	649	220	6.72	0.51	0.62	20%	65%	4,361	66	265	262	141
10	10	251	Residential (8-14 DU/Acre)	DUs	26.21	366	230	5.86	0.44	0.52	17%	67%	2,145	27	134	128	63
11	11	254	Residential (5-8 DU/Acre)	DUs	99.36	783	210	9.57	0.75	1.01	25%	63%	7,493	147	440	498	293
12	12	256	K-8 School	Students	21.00	600	520	1.29	0.42	0.28	55%	45%	774	139	113	76	92
13	13	259	Residential (5-8 DU/Acre)	DUs	79.40	635	210	9.57	0.75	1.01	25%	63%	6,077	119	357	404	237
14	14	269	Commercial	TGSF	21.20	194	820	53.85	1.20	5.00	61%	48%	10,447	142	91	466	504
15	15	270	Residential (14-25 DU/Acre)	DUs	9.97	249	220	6.72	0.51	0.62	20%	65%	1,673	25	102	100	54
16	16A		Village Center (Residential)	DUs	29.87	506	220	6.72	0.51	0.62	20%	65%	3,400	52	206	204	110
16	16B		Viallge Center (General Office)	TGSF	8.66	282.997	710	3.77	0.58	0.46	88%	17%	1,067	144	20	22	108
16	16C		Village Center (Commercial)	TGSF	6.57	214.688	820	51.98	1.15	4.83	61%	48%	11,159	151	96	498	539
	16	280	Sum Village Center Parcel 16	~	~	~	~	~	~	~	~	~	15,627	347	322	724	757
17	17	282	Residential (14-25 DU/Acre)	DUs	9.97	249	220	6.72	0.51	0.62	20%	65%	1,673	25	102	100	54
18	18A		Village Center (Residential)	DUs	29.87	507	220	6.72	0.51	0.62	20%	65%	3,407	52	207	204	110
18	18B		Viallge Center (General Office)	TGSF	8.66	282.997	710	3.77	0.58	0.46	88%	17%	1,067	144	20	22	108
18	18C		Village Center (Commercial)	TGSF	6.57	214.688	820	51.98	1.15	4.83	61%	48%	11,159	151	96	498	539
	18	283	Sum Village Center Parcel 18	~	~	~	~	~	~	~	~	~	15,633	347	323	724	757
19	19	285	Residential (8-14 DU/Acre)	DUs	25.44	356	230	5.86	0.44	0.52	17%	67%	2,086	27	130	124	61
20	20	287	Residential (14-25 DU/Acre)	DUs	7.68	192	220	6.72	0.51	0.62	20%	65%	1,290	20	78	77	42
21	21	290	Residential (14-25 DU/Acre)	DUs	9.93	248	220	6.72	0.51	0.62	20%	65%	1,667	25	101	100	54
22	22	291	Business Park	TGSF	40.00	635	770	12.76	1.43	1.29	84%	23%	8,103	763	145	188	631
23	23	293	General Office	TGSF	6.20	68	710	4.73	0.70	0.46	88%	17%	322	42	6	5	26
			Sum of DUs			8,099							117,006	2,969	4,373	6,100	5,270

Cooley Station

								Trip Rates					Total				
TAZ	Parcel #	TC ID	Parcel Type	Units	Acres	Amount	L.U.C.	Daily Rate	AM Rate	PM Rate	% In AM	% In PM	Weekday	AM In	AM Out	PM In	PM Out
1	1	223	Residential (5-8 DU/Acre)	DUs	79.13	633	210	9.57	0.75	1.01	25%	63%	6,058	119	356	403	237
2	2	226	Residential (5-8 DU/Acre)	DUs	78.84	630	210	9.57	0.75	1.01	25%	63%	6,029	118	354	401	235
3	3	230	Residential (8-14 DU/Acre)	DUs	16.02	224	230	5.86	0.44	0.52	17%	67%	1,313	17	82	78	38
4	4	233	Residential (8-14 DU/Acre)	DUs	13.44	188	230	5.86	0.44	0.52	17%	67%	1,102	14	69	65	32
5	5	238	Residential (14-25 DU/Acre)	DUs	29.78	744	220	6.72	0.51	0.62	20%	65%	5,000	76	304	300	161
6	6A	–	Village Center (Residential)	DUs	10.01	171	220	6.72	0.51	0.62	20%	65%	1,149	17	70	69	37
6	6B	–	Viallge Center (General Office)	TGSF	2.90	94.8377	710	4.49	0.67	0.46	88%	17%	426	56	8	7	36
6	6C	–	Village Center (Commercial)	TGSF	2.20	71.9459	820	76.21	1.79	7.00	61%	48%	5,483	79	50	242	262
	6	241	Sum Village Center Parcel 6	–	–	–	–	–	–	–	–	–	7,058	152	128	318	335
7	7A	–	Village Center (Residential)	DUs	10.01	171	220	6.72	0.51	0.62	20%	65%	1,149	17	70	69	37
7	7B	–	Viallge Center (General Office)	TGSF	2.90	94.8377	710	4.49	0.67	0.46	88%	17%	426	56	8	7	36
7	7C	–	Village Center (Commercial)	TGSF	2.20	71.9459	820	76.21	1.79	7.00	61%	48%	5,483	79	50	242	262
	7	245	Sum Village Center Parcel 7	–	–	–	–	–	–	–	–	–	7,058	152	128	318	335
8	8	248	Residential (14-25 DU/Acre)	DUs	23.94	598	220	6.72	0.51	0.62	20%	65%	4,019	61	244	241	130
9	9	250	Residential (14-25 DU/Acre)	DUs	25.97	649	220	6.72	0.51	0.62	20%	65%	4,361	66	265	262	141
10	10	251	Residential (8-14 DU/Acre)	DUs	26.21	366	230	5.86	0.44	0.52	17%	67%	2,145	27	134	128	63
11	11	254	Residential (5-8 DU/Acre)	DUs	99.36	783	210	9.57	0.75	1.01	25%	63%	7,493	147	440	498	293
12	12	256	K-8 School	Students	21.00	600	520	1.29	0.42	0.28	55%	45%	774	139	113	76	92
13	13	259	Residential (5-8 DU/Acre)	DUs	79.40	635	210	9.57	0.75	1.01	25%	63%	6,077	119	357	404	237
14	14	269	Commercial	TGSF	21.20	194	820	53.85	1.20	5.00	61%	48%	10,447	142	91	466	504
15	15	270	Residential (14-25 DU/Acre)	DUs	9.97	249	220	6.72	0.51	0.62	20%	65%	1,673	25	102	100	54
16	16A		Village Center (Residential)	DUs	29.87	506	220	6.72	0.51	0.62	20%	65%	3,400	52	206	204	110
16	16B		Viallge Center (General Office)	TGSF	8.66	282.997	710	3.77	0.58	0.46	88%	17%	1,067	144	20	22	108
16	16C		Village Center (Commercial)	TGSF	6.57	214.688	820	51.98	1.15	4.83	61%	48%	11,159	151	96	498	539
	16	280	Sum Village Center Parcel 16	–	–	–	–	–	–	–	–	–	15,627	347	322	724	757
17	17	282	Residential (14-25 DU/Acre)	DUs	9.97	249	220	6.72	0.51	0.62	20%	65%	1,673	25	102	100	54
18	18A		Village Center (Residential)	DUs	29.87	507	220	6.72	0.51	0.62	20%	65%	3,407	52	207	204	110
18	18B		Viallge Center (General Office)	TGSF	8.66	282.997	710	3.77	0.58	0.46	88%	17%	1,067	144	20	22	108
18	18C		Village Center (Commercial)	TGSF	6.57	214.688	820	51.98	1.15	4.83	61%	48%	11,159	151	96	498	539
	18	283	Sum Village Center Parcel 18	–	–	–	–	–	–	–	–	–	15,633	347	323	724	757
19	19	285	Residential (8-14 DU/Acre)	DUs	25.44	356	230	5.86	0.44	0.52	17%	67%	2,086	27	130	124	61
20	20	287	Residential (14-25 DU/Acre)	DUs	7.68	192	220	6.72	0.51	0.62	20%	65%	1,290	20	78	77	42
21	21	290	Residential (14-25 DU/Acre)	DUs	9.93	248	220	6.72	0.51	0.62	20%	65%	1,667	25	101	100	54
22	22	291	Business Park	TGSF	40.00	635	770	12.76	1.43	1.29	84%	23%	8,103	763	145	188	631
23	23	293	General Office	TGSF	6.20	68	710	4.73	0.70	0.46	88%	17%	322	42	6	5	26
			Sum of DUs			8,099							117,006	2,969	4,373	6,100	5,270

Cooley Station

TAZ	Parcel #	TC ID	Parcel Type	Units	Acres	Amount	L.U.C.	% Attractions	Trip Productions					Trip Attractions				
									Weekday	AM In	AM Out	PM In	PM Out	Weekday	AM In	AM Out	PM In	PM Out
1	1	223	Residential (5-8 DU/Acre)	DUs	79.13	633	210	5%	5,755	113	338	383	225	303	6	18	20	12
2	2	226	Residential (5-8 DU/Acre)	DUs	78.84	630	210	5%	5,728	112	337	381	224	301	6	18	20	12
3	3	230	Residential (8-14 DU/Acre)	DUs	16.02	224	230	5%	1,247	16	78	74	37	66	1	4	4	2
4	4	233	Residential (8-14 DU/Acre)	DUs	13.44	188	230	5%	1,047	13	65	62	31	55	1	3	3	2
5	5	238	Residential (14-25 DU/Acre)	DUs	29.78	744	220	5%	4,750	72	288	285	153	250	4	15	15	8
6	6A	~	Village Center (Residential)	DUs	10.01	171	220	5%	1,092	17	66	65	35	57	1	3	3	2
6	6B	~	Village Center (General Office)	TGSF	2.90	94.8377	710	60%	170	22	3	3	14	255	34	5	4	22
6	6C	~	Village Center (Commercial)	TGSF	2.20	71.9459	820	60%	2,193	31	20	97	105	3,290	47	30	145	157
	6	241	Sum Village Center Parcel 6	~	~	~	~	~	3,455	70	89	165	154	3,603	82	38	153	181
7	7A	~	Village Center (Residential)	DUs	10.01	171	220	5%	1,092	17	66	65	35	57	1	3	3	2
7	7B	~	Village Center (General Office)	TGSF	2.90	94.8377	710	60%	170	22	3	3	14	255	34	5	4	22
7	7C	~	Village Center (Commercial)	TGSF	2.20	71.9459	820	60%	2,193	31	20	97	105	3,290	47	30	145	157
	7	245	Sum Village Center Parcel 7	~	~	~	~	~	3,455	70	89	165	154	3,603	82	38	153	181
8	8	248	Residential (14-25 DU/Acre)	DUs	23.94	598	220	5%	3,818	58	232	229	123	201	3	12	12	6
9	9	250	Residential (14-25 DU/Acre)	DUs	25.97	649	220	5%	4,143	63	252	248	134	218	3	13	13	7
10	10	251	Residential (8-14 DU/Acre)	DUs	26.21	366	230	5%	2,038	26	127	121	60	107	1	7	6	3
11	11	254	Residential (5-8 DU/Acre)	DUs	99.36	783	210	5%	7,119	139	418	473	278	375	7	22	25	15
12	12	256	K-8 School	Students	21.00	600	520	85%	116	21	17	11	14	658	118	96	64	79
13	13	259	Residential (5-8 DU/Acre)	DUs	79.40	635	210	5%	5,773	113	339	384	225	304	6	18	20	12
14	14	269	Commercial	TGSF	21.20	194	820	50%	5,223	71	45	233	252	5,223	71	45	233	252
15	15	270	Residential (14-25 DU/Acre)	DUs	9.97	249	220	5%	1,590	24	97	95	51	84	1	5	5	3
16	16A		Village Center (Residential)	DUs	29.87	506	220	5%	3,230	49	196	194	104	170	3	10	10	5
16	16B		Village Center (General Office)	TGSF	8.66	282.997	710	60%	427	58	8	9	43	640	87	12	13	65
16	16C		Village Center (Commercial)	TGSF	6.57	214.688	820	60%	4,464	60	39	199	216	6,696	90	58	299	324
	16	280	Sum Village Center Parcel 16	~	~	~	~	~	8,121	167	243	402	363	7,506	180	80	322	394
17	17	282	Residential (14-25 DU/Acre)	DUs	9.97	249	220	5%	1,590	24	97	95	51	84	1	5	5	3
18	18A		Village Center (Residential)	DUs	29.87	507	220	5%	3,237	49	197	194	105	170	3	10	10	6
18	18B		Village Center (General Office)	TGSF	8.66	282.997	710	50%	533	72	10	11	54	533	72	10	11	54
18	18C		Village Center (Commercial)	TGSF	6.57	214.688	820	50%	5,580	75	48	249	270	5,580	75	48	249	270
	18	283	Sum Village Center Parcel 18	~	~	~	~	~	9,350	197	255	454	428	6,284	150	68	270	329
19	19	285	Residential (8-14 DU/Acre)	DUs	25.44	356	230	5%	1,982	25	124	118	58	104	1	7	6	3
20	20	287	Residential (14-25 DU/Acre)	DUs	7.68	192	220	5%	1,226	19	74	74	40	65	1	4	4	2
21	21	290	Residential (14-25 DU/Acre)	DUs	9.93	248	220	5%	1,583	24	96	95	51	83	1	5	5	3
22	22	291	Business Park	TGSF	40.00	635	770	50%	4,051	381	73	94	315	4,051	381	73	94	315
23	23	293	General Office	TGSF	6.20	68	710	50%	161	21	3	3	13	161	21	3	3	13
			Sum of DUs			**8,099**		**3**	**83,319**	**1,840**	**3,775**	**4,644**	**3,435**	**33,688**	**1,128**	**598**	**1,456**	**1,835**

TCAD ID is the ID unique to the TransCAD modeling program used to identify the endpoint associated with each parcel.

Parcel Type describes the parcel use.

Units specifies the units of land use used for generating trips. "Thousands of Gross Square Feet" is abbreviated TGSF. Dwelling units is abbreviated DUs.

Amount is the number of units in the parcel (i.e. 544 Thousand Gross Square Feet or 134 Dwelling Units).

LUC is the ITE Land Use Code. It refers to the section of the ITE manual from which the trip rates were obtained.

Rates present the number of daily, AM peak hour and PM peak hour vehicle trips to and from the subject land use per unit.

Percent In is the percentage of AM and PM vehicle trips arriving inbound at the land use. The remaining percent of trips are leaving outbound. For instance, 25 percent of AM peak hour trips are arriving at a single family home, and the remaining 75 percent are leaving the home. For daily trips, it is assumed that 50 percent are inbound trips and 50 percent are outbound trips.

Trips are the calculated number of trips. They are calculated as the amount times the rate times the percent inbound or outbound.

Productions and Attractions for adjacent developments can be found in Appendix D. Detailed trip generation tables for the adjacent developments are shown in Appendix C. The total internal Productions for the study area are more than the total internal Attractions. The difference is Attractions to external stations. These are trips between the study area and other locations in the metropolitan region.

TRIP DISTRIBUTION

Trip distribution is the process of assigning a starting location for each inbound trip to the site and an ending location for each outbound trip. Daily, AM peak hour and PM peak hour trips are distributed separately.

External trips are split between a number of external stations, which represent arterial approaches to the study area. Total external trip Attractions are calculated as the difference between internal Productions and internal Attractions. Specifically;

Total Daily A(Ext) = Total Daily P(Int) – Total Daily A(Int)
Total AM-In A(Ext) = Total AM-Out P(Int) – Total AM-In A(Int)
Total AM-Out A(Ext) = Total AM-In P(Int) – Total AM-Out A(Int)
Total PM-In A(Ext) = Total PM-Out P(Int) – Total PM-In A(Int)
Total PM-Out A(Ext) = Total PM-In P(Int) – Total PM-Out A(Int)

Where,

Daily = ADT trip generation
A = Attractions
P = Productions
Int = Internal zone
Ext = External station

Site trips were distributed by direction proportionally to the sum of Year 2020 population and employment forecasts within ten miles of the center of the site. These projections were obtained from Year 2020 Population and Employment projections by the Maricopa Association of Government (MAG). These values are shown in Table 3. A worksheet of MAG data for the site is included in Appendix B.

Table 3
Trip Distribution Percentages
Cooley Station Traffic Impact Study

Direction	Trip Distribution Percentage
Higley Road, North	20%
Recker Road, North	2%
Power Road, North	2%
San Tan Freeway, East	15%
Ray Road, East	3%
Williams Field Road, East	5%
Pecos Road, East	1%
Power Road, South	2%
Higley Road, South	4%
Pecos Road, West	5%
Williams Field Road, West	10%
Ray Road, West	10%
San Tan Freeway, West	21%
Total	100%

The next step is to run the TransCAD program gravity model to create tables of trip origins and destinations. The gravity model is the most widely used trip distribution model. This model explicitly relates flows between zones to inter-zonal impedance to travel.

The assumption behind the gravity model is that the number of trips produced at zone i that are attracted to zone j is proportional to:

- The number of trips produced in zone i
- The number of trips attracted to zone j
- A function of the relative impedance between the zones, called impedance.

For this study the impedance between zones i and j is defined as:

$$F(c_{ij}) = (1/c_{ij}) \times e^{-0.01(cij)},$$

Where, c_{ij} = travel time between zones i and j, which is distance times 60 divided by miles per hour. For external stations, a distance to the average location for trips going in that direction was added to the calculation of distance. The final step is to convert the trip matrices from the gravity model into trip matrices ready to assign to the network.

There are three trip matrices for assignment:

1. **Average Daily Traffic (ADT)** This is the daily trip table, balanced so that trips from zone i to zone j equal trips from zone j to zone i.
2. **AM Trip Table** The trip table made with AM inbound Productions and outbound Attractions is transposed and added to the trip table made with AM outbound Productions and inbound Attractions.
3. **PM Trip Table** The trip table made with PM inbound Productions and outbound Attractions is transposed and added to the trip table made with PM outbound Productions and inbound Attractions.

STUDY AREA TRAFFIC ASSIGNMENT

A traffic assignment was performed with the use of TransCAD transportation software. Vehicle trips between each origin and destination were determined as outlined above and combined in an origin-destination (O-D) matrix in TransCAD. A graphical representation of the transportation network servicing the study area was also created in TransCAD. The flows of traffic for each O-D pair in the matrix were loaded onto the transportation network. The number of trips assigned to a roadway is based upon the travel time each path could carry.

A User Equilibrium Capacity Restraint method was used to assign the trips within TransCAD. Capacity Restraint recalculates travel time on roadways based on the volume and level of congestion on them. The program then reassigns trips using the new travel times. This is repeated up to 20 iterations to achieve an equilibrium solution. Background traffic is included for the recalculation of travel time in each iteration.

User equilibrium uses an iterative process to achieve a convergent solution in which no traveler can improve his or her travel time by shifting routes.

In each iteration, network link flows are computed, which incorporate link capacity restraint effects and flow-dependent travel times. The formulation of the User Equilibrium problem as a mathematical program and the Frank-Wolf solution method employed in TransCAD are described in the TransCAD user manual, Technical Notes section in Chapter 9.

This process was first completed for the entire study area with full access on all site roadways and accesses. Figure 3 presents an area key map for the study area. Figure 4 presents the study area average daily traffic for full buildout, and Figure 5 presents AM and PM peak hour turning movements at critical intersections, expected to be traveling to and from the study area.

As mentioned in the TRIP GENERATION section, the study area includes the Cooley Station development, and several adjacent parcels. The adjacent parcels are the adjacent Park, the Dibella commercial and residential property and the adjacent existing high school.

BACKGROUND TRAFFIC

Background traffic is the amount of traffic that would be on area roads in the future, if the proposed development were not built.

For Year 2025, background values on the roadways were determined by subtracting the study area traffic, as described in the previous section, from the Year 2025 MAG projections for the area.

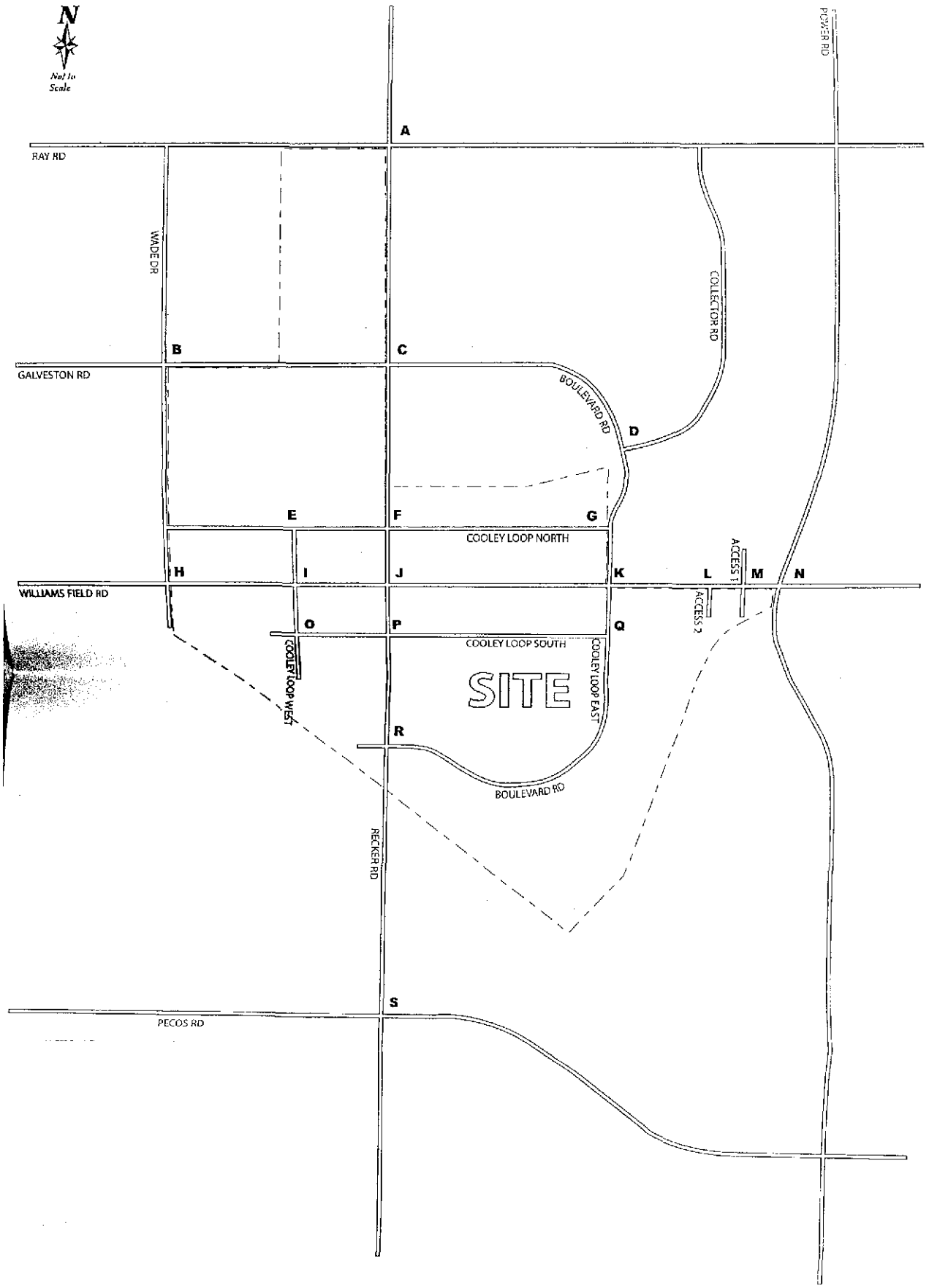
For Year 2015, the background traffic for Year 2025 calculated above was then taken and interpolated between existing counts and Year 2025 to obtain Year 2015 background volumes.

For Year 2025, average daily traffic was converted to hourly volumes using the following formula:

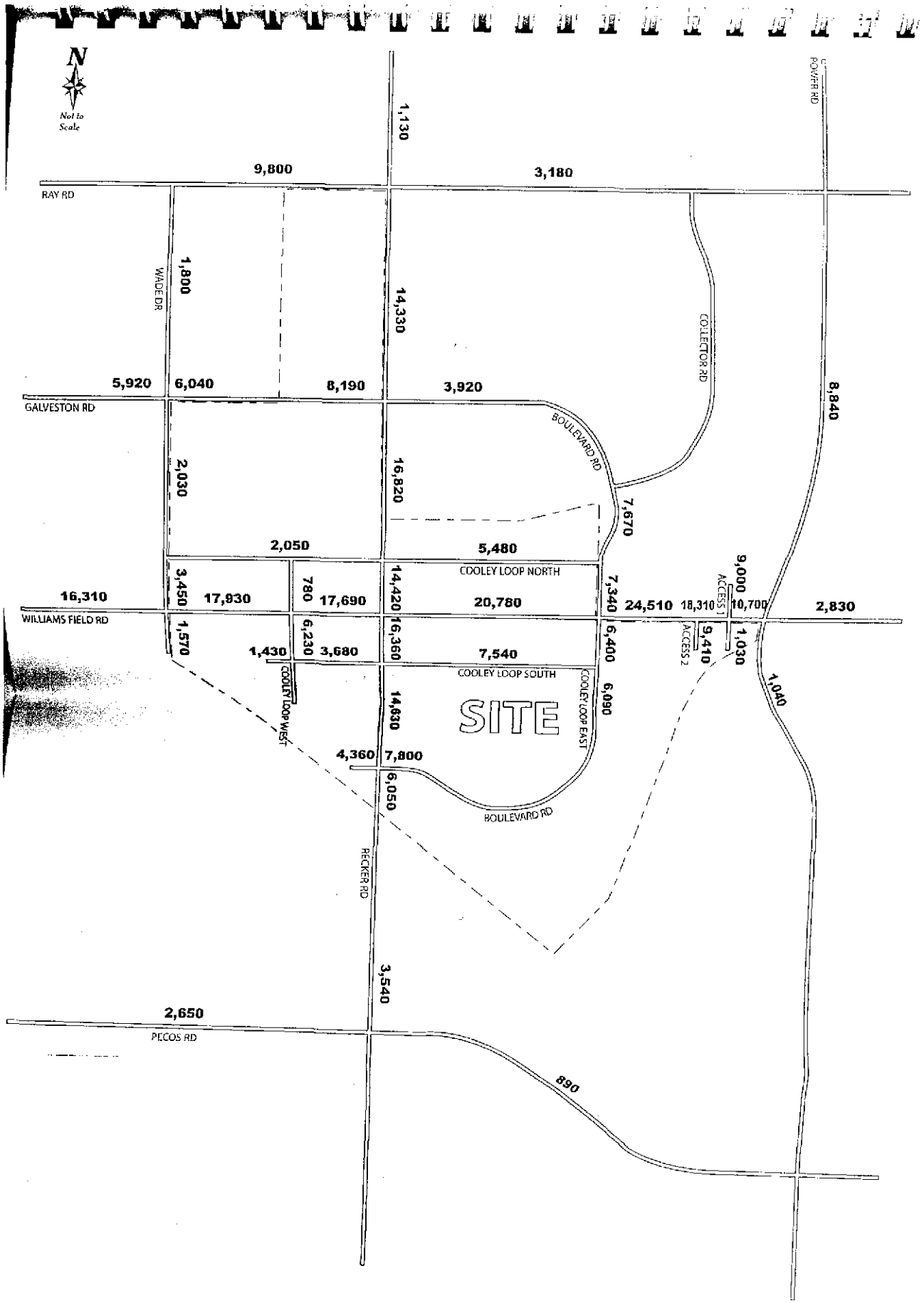
$$DDHV = AADT \times K \times D$$

Where:
AADT = forecast average annual daily traffic (vpd)
DDHV = directional design hourly volume (vph)
K = percent of AADT occurring in the peak hour, and
D = percent of peak-hour traffic in the heaviest direction.

A K value of 0.09 was used for the roadways. A D value of 60 percent was used, going westbound and northbound during the AM peak hour, and eastbound and southbound during the PM peak hour. To estimate total background AM and PM peak hour turns, a nonlinear programming procedure was developed. This inputs the approach and departure volumes determined above and a starting estimate of percent right and left turns for each approach.



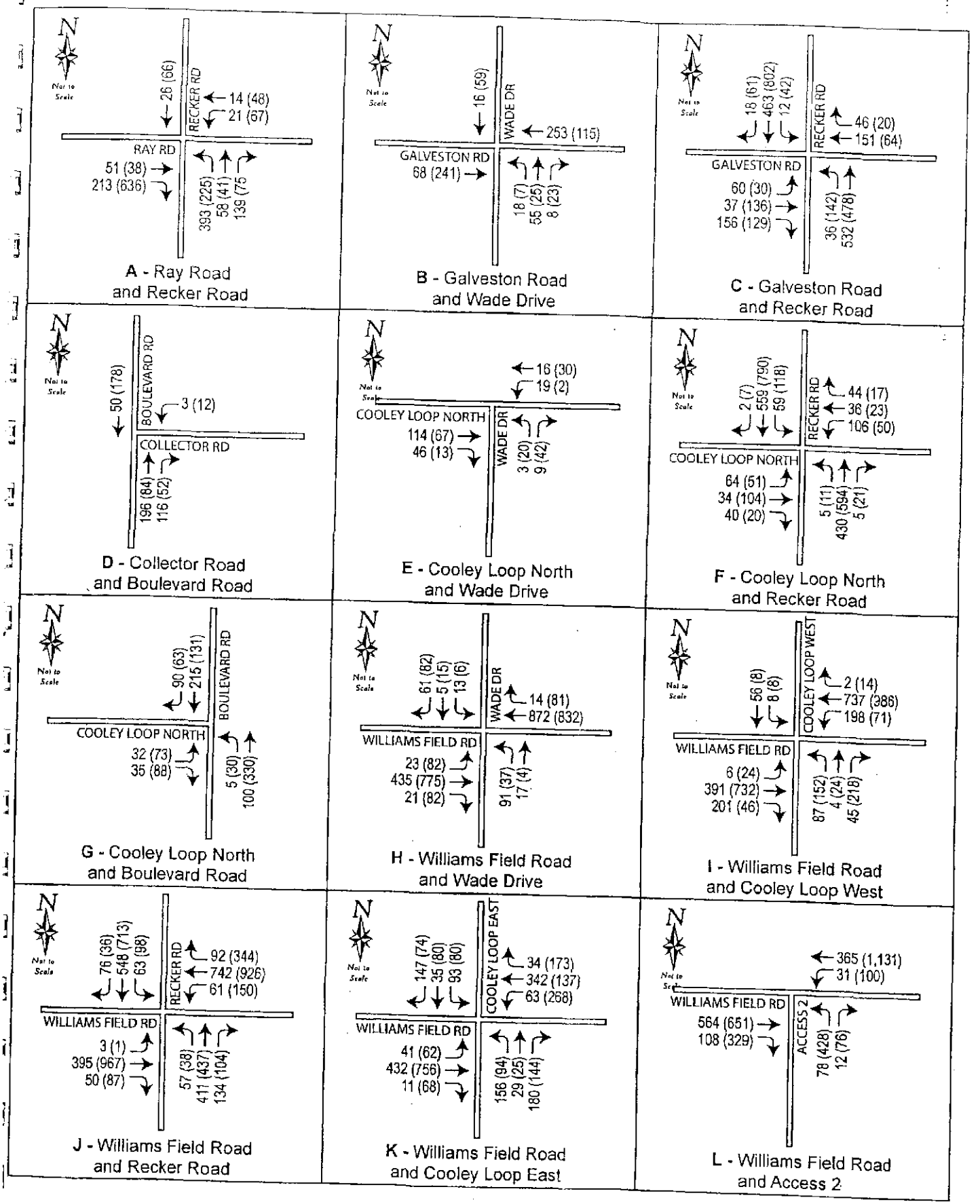
LEGEND:
X (Y) : AM (PM) Peak Hour Traffic
Z : Average Daily Traffic (in bold font)

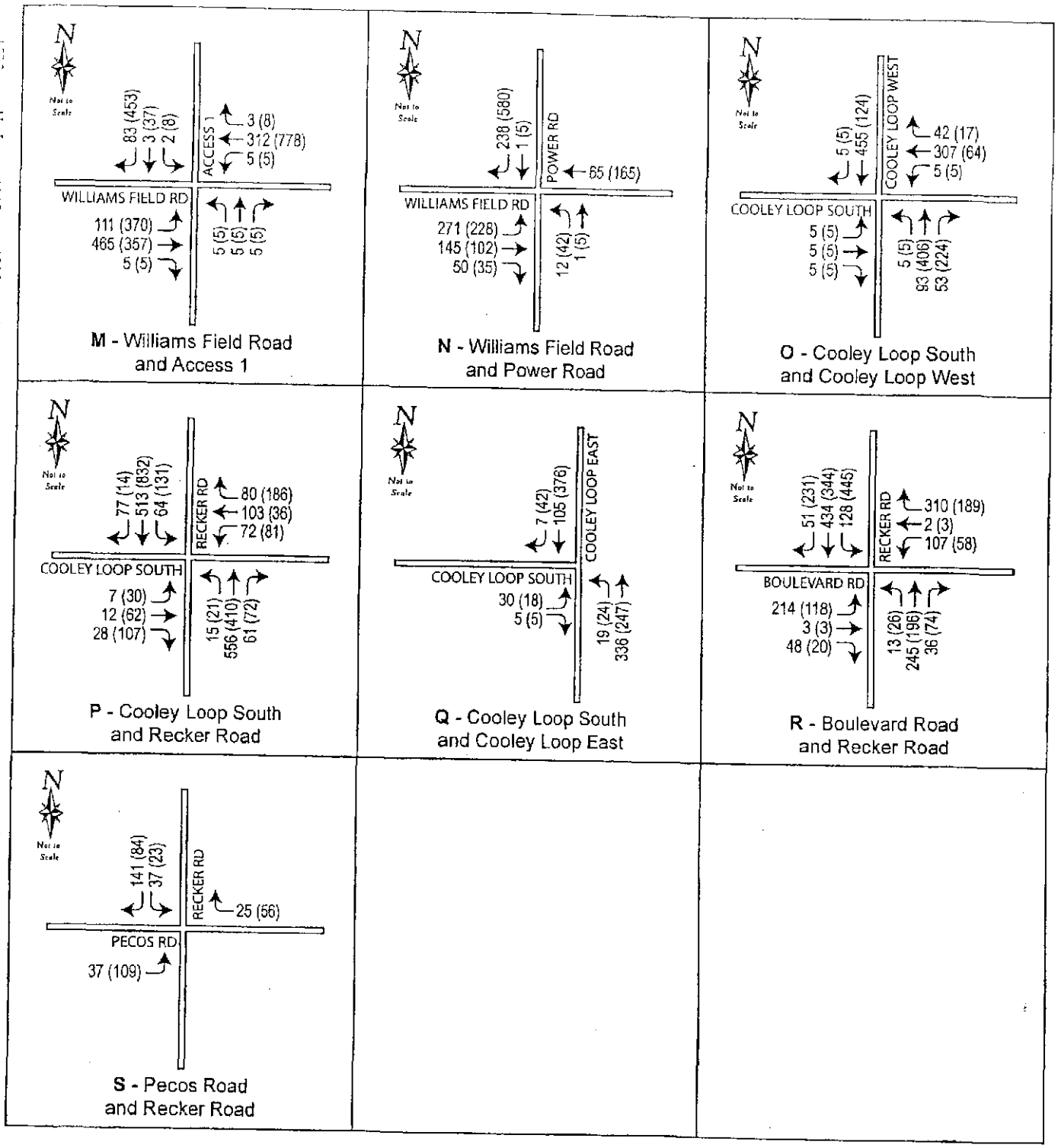


LEGEND:
Z : Average Daily Traffic (In bold font)

TASK ENGINEERING

Average Daily Study Area Traffic


N
Not to Scale
RECKER RD
RAY RD
26 (66)
14 (48)
21 (67)
51 (38)
213 (636)
393 (225)
58 (41)
139 (75)
A - Ray Road and Recker Road
WADE DR
GALVESTON RD
16 (59)
253 (115)
68 (241)
18 (7)
55 (25)
8 (23)
B - Galveston Road and Wade Drive
RECKER RD
GALVESTON RD
18 (61)
463 (802)
12 (42)
46 (20)
151 (64)
60 (30)
37 (136)
156 (129)
36 (142)
532 (478)
C - Galveston Road and Recker Road
BOULEVARD RD
COLLECTOR RD
50 (178)
3 (12)
196 (84)
116 (52)
D - Collector Road and Boulevard Road
WADE DR
COOLEY LOOP NORTH
16 (30)
19 (2)
114 (67)
46 (13)
3 (20)
9 (42)
E - Cooley Loop North and Wade Drive
RECKER RD
COOLEY LOOP NORTH
2 (7)
559 (790)
59 (118)
44 (17)
36 (23)
106 (50)
64 (51)
34 (104)
40 (20)
5 (11)
430 (594)
5 (21)
F - Cooley Loop North and Recker Road
BOULEVARD RD
COOLEY LOOP NORTH
90 (63)
215 (131)
32 (73)
35 (88)
5 (30)
100 (330)
G - Cooley Loop North and Boulevard Road
WADE DR
WILLIAMS FIELD RD
61 (82)
5 (15)
13 (6)
14 (81)
872 (832)
23 (82)
435 (775)
21 (82)
91 (37)
17 (4)
H - Williams Field Road and Wade Drive
COOLEY LOOP WEST
WILLIAMS FIELD RD
56 (8)
8 (8)
2 (14)
737 (386)
198 (71)
6 (24)
391 (732)
201 (46)
87 (152)
4 (24)
45 (218)
I - Williams Field Road and Cooley Loop West
RECKER RD
WILLIAMS FIELD RD
76 (36)
548 (713)
63 (98)
92 (344)
742 (926)
61 (150)
3 (1)
395 (967)
50 (87)
57 (38)
411 (437)
134 (104)
J - Williams Field Road and Recker Road
COOLEY LOOP EAST
WILLIAMS FIELD RD
147 (74)
35 (80)
93 (80)
34 (173)
342 (137)
63 (268)
41 (62)
432 (756)
11 (68)
156 (94)
29 (25)
180 (144)
K - Williams Field Road and Cooley Loop East
ACCESS 2
WILLIAMS FIELD RD
365 (1,131)
31 (100)
564 (651)
108 (329)
78 (428)
12 (76)
L - Williams Field Road and Access 2


N
Not to Scale
83 (453)
3 (37)
2 (8)
ACCESS 1
3 (8)
312 (778)
5 (5)
WILLIAMS FIELD RD
111 (370)
465 (357)
5 (5)
5 (5)
5 (5)
5 (5)
M - Williams Field Road and Access 1
238 (580)
1 (5)
POWER RD
65 (165)
WILLIAMS FIELD RD
271 (228)
145 (102)
50 (35)
12 (42)
1 (5)
N - Williams Field Road and Power Road
5 (5)
455 (124)
COOLEY LOOP WEST
42 (17)
307 (64)
5 (5)
COOLEY LOOP SOUTH
5 (5)
5 (5)
5 (5)
5 (5)
93 (406)
53 (224)
O - Cooley Loop South and Cooley Loop West
77 (14)
513 (832)
64 (131)
RECKER RD
80 (186)
103 (36)
72 (81)
COOLEY LOOP SOUTH
7 (30)
12 (62)
28 (107)
15 (21)
556 (410)
61 (72)
P - Cooley Loop South and Recker Road
7 (42)
105 (376)
COOLEY LOOP EAST
COOLEY LOOP SOUTH
30 (18)
5 (5)
19 (24)
336 (247)
Q - Cooley Loop South and Cooley Loop East
51 (231)
434 (344)
128 (445)
RECKER RD
310 (189)
2 (3)
107 (58)
BOULEVARD RD
214 (118)
3 (3)
48 (20)
13 (26)
245 (196)
36 (74)
R - Boulevard Road and Recker Road
141 (84)
37 (23)
RECKER RD
25 (56)
PECOS RD
37 (109)
S - Pecos Road and Recker Road

This procedure produces turn volumes, which minimizes the following objective function:

$$\text{Min. } K = \Sigma(V_E - V_C)^2 + 0.5 \times \Sigma(T_E - T_C)^2$$

Subject to: Total approach volume = Total departure volume
Approach volumes are held constant
All turns are non-negative
Approach and departure volumes are summation of turn volumes

Where: V_E, V_C = Estimated and output approach and departure volumes
T_E, T_C = Estimated and output turning volumes for each approach.

Before running the optimization routine, total approach and departure volumes are balanced. This approach was used to estimate background traffic for Year 2025.

The resulting background average daily traffic for Year 2015 is shown on Figure 6, while the resulting average daily traffic for Year 2025 is shown on Figure 7, with AM and PM peak hour turning movements for Year 2025 shown on Figure 8.

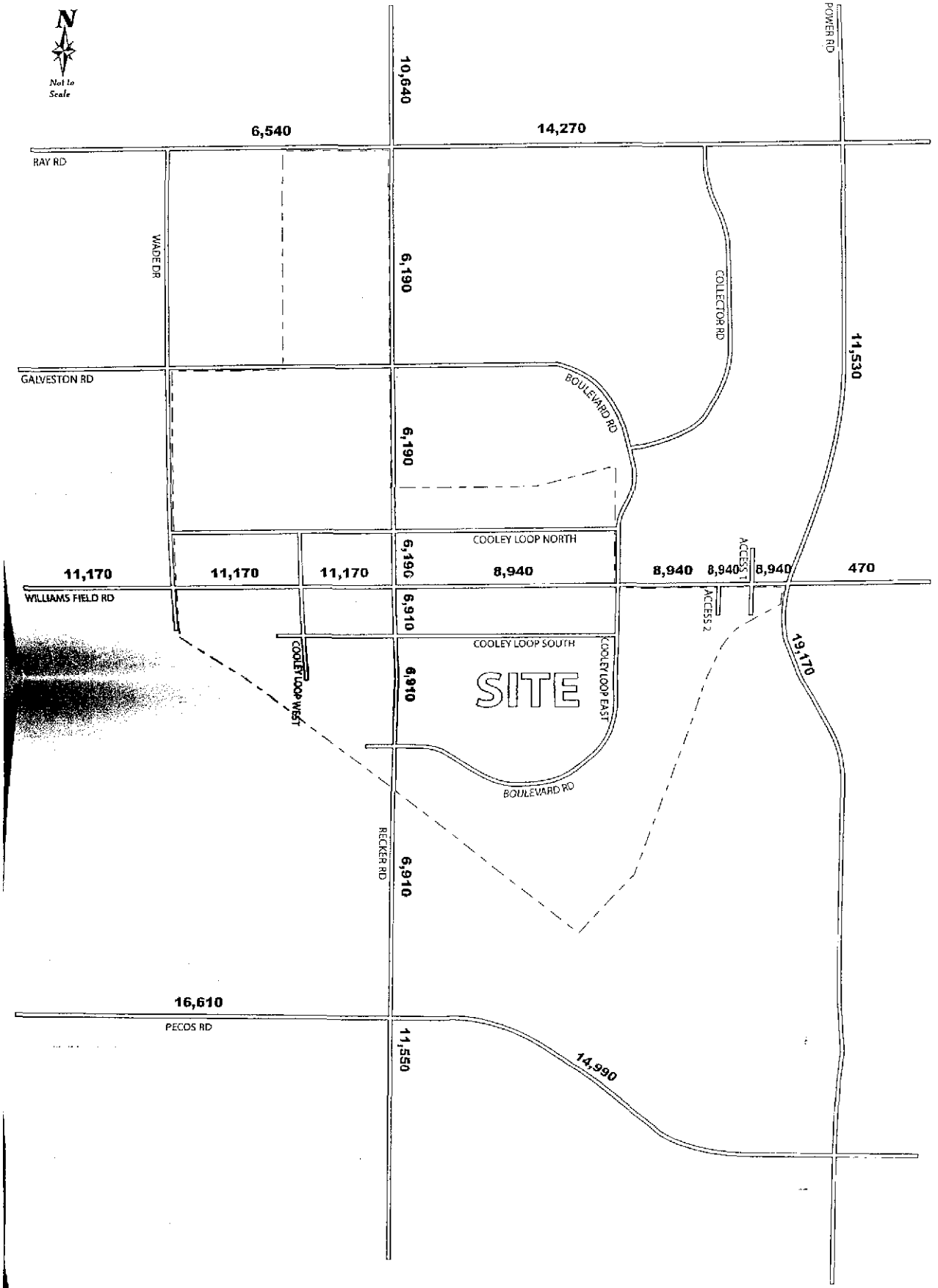
TOTAL TRAFFIC

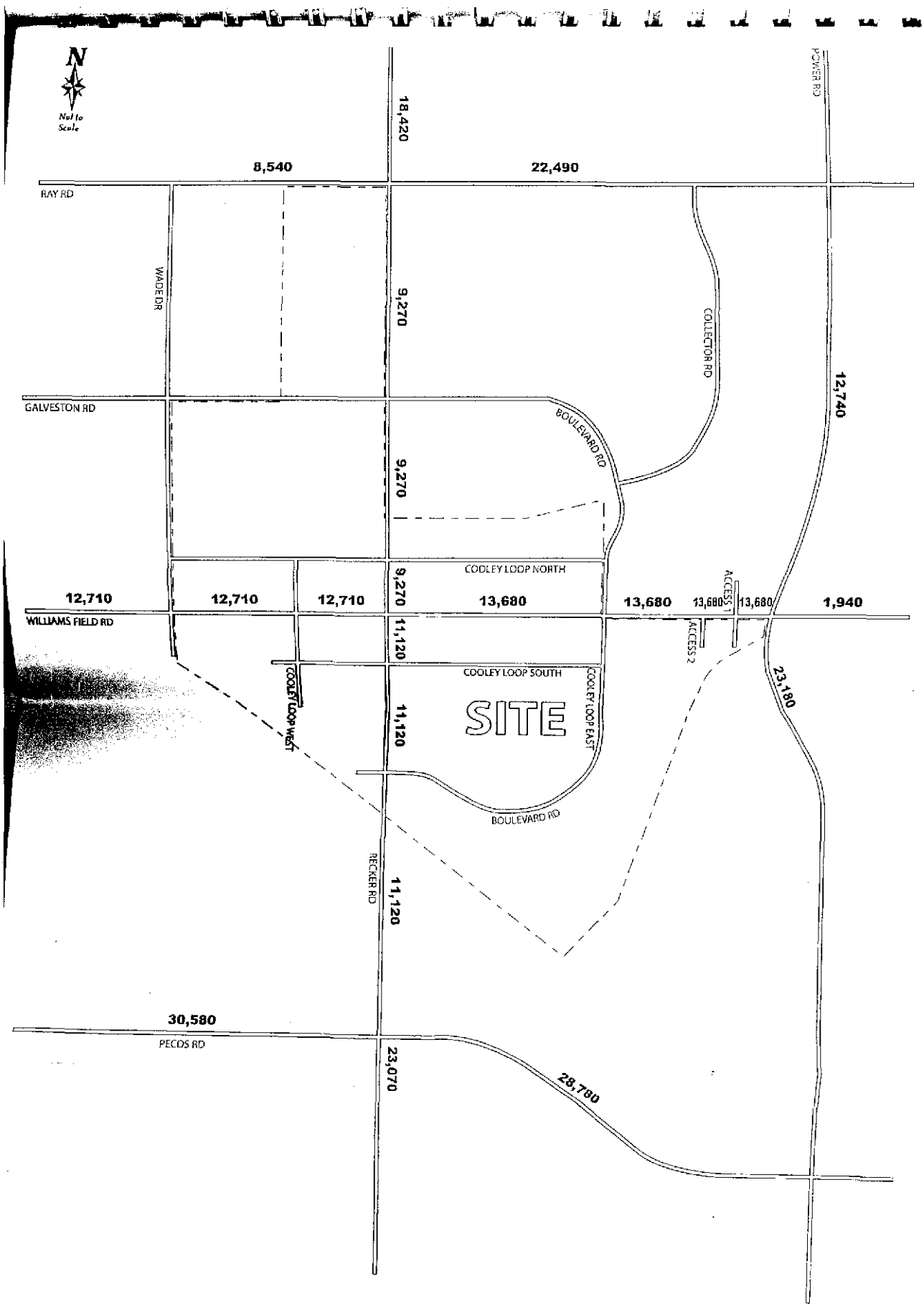
Total traffic is the sum of the site traffic plus the background traffic. Total estimated Year 2015 average daily traffic is shown on Figure 9. Total estimated average daily traffic for Year 2025 is shown on Figure 10, with AM and PM peak hour turning movements shown on Figure 11 for Year 2025.

TRAFFIC ANALYSIS

For Year 2015, generalized average daily service volumes by level of service (LOS) were used to estimate needed lanes. These daily service volumes were taken from Table 4-2 of *Quality/Level of Service Handbook*, prepared by State of Florida Department of Transportation, 2002. Excerpts from this publication are found in Appendix E. Level of service C was used to determine the break point between two-lane and four-lane roads, and Level of service D volume was used to determine the break between four-lane and six-lane roads. Roads operating at the low end of the range of service volumes are not recommended to have medians. These are minor arterials or collectors. The resulting recommended lanes for Year 2015 are found on Figure 12.

For Year 2025, the critical intersections were analyzed using the methodologies presented in the *Highway Capacity Manual, 2000 Edition*, and were evaluated using *HCS 2000 Software*. Capacity analysis was completed for both AM and PM peak hours for total Year 2025 traffic including full site buildout conditions.


N
Not to Scale
POWER RD
10,640
6,540
14,270
RAY RD
WADE DR
6,190
COLLECTOR RD
11,530
GALVESTON RD
BOULEVARD RD
6,190
COOLEY LOOP NORTH
11,170
11,170
11,170
6,190
8,940
8,940
8,940
8,940
470
ACCESS 1
ACCESS 2
WILLIAMS FIELD RD
6,910
COOLEY LOOP SOUTH
COOLEY LOOP WEST
SITE
COOLEY LOOP EAST
19,170
6,910
BOULEVARD RD
RECKER RD
6,910
16,610
PECOS RD
11,550
14,990
LEGEND:
: Average Daily Traffic (in bold font)

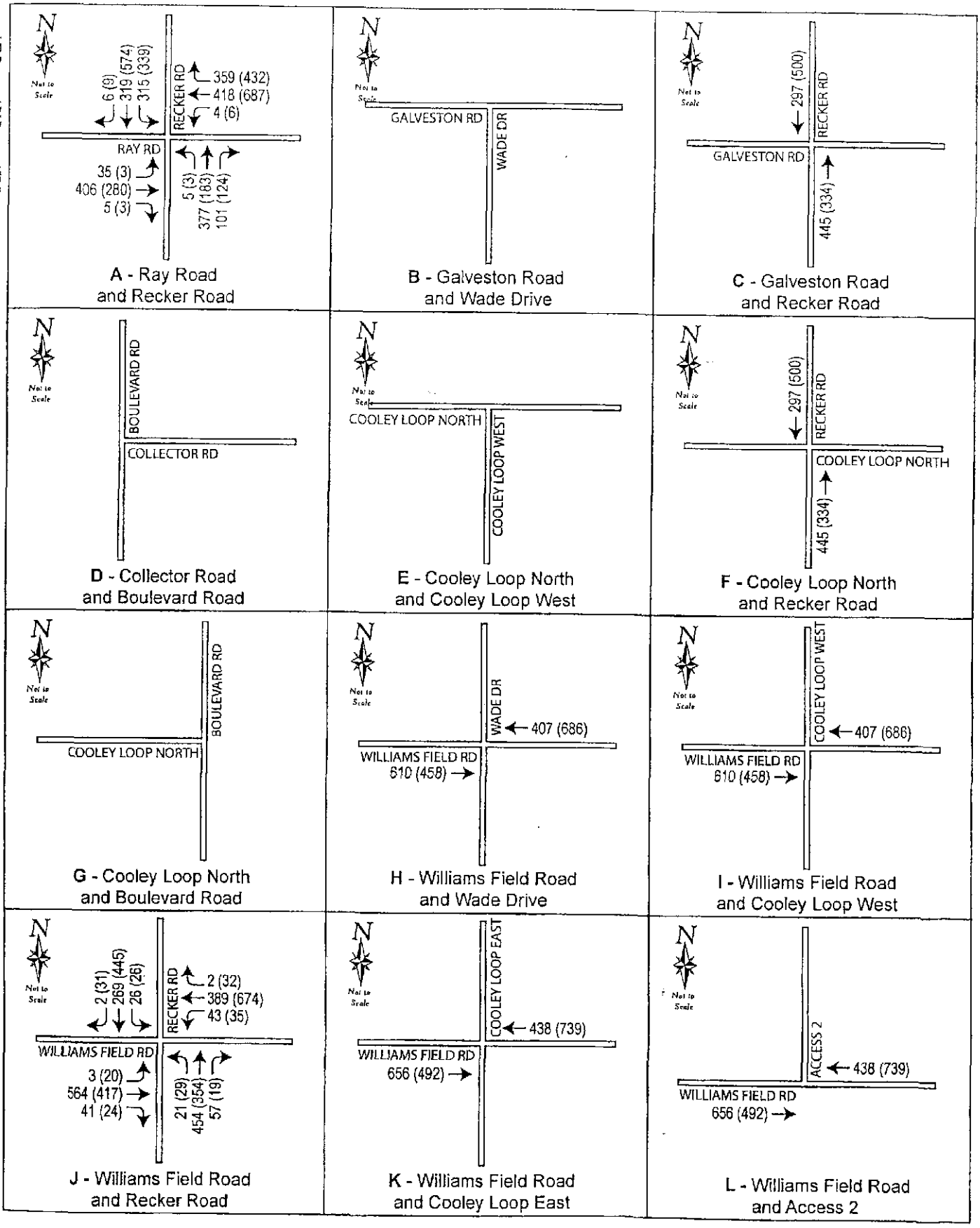


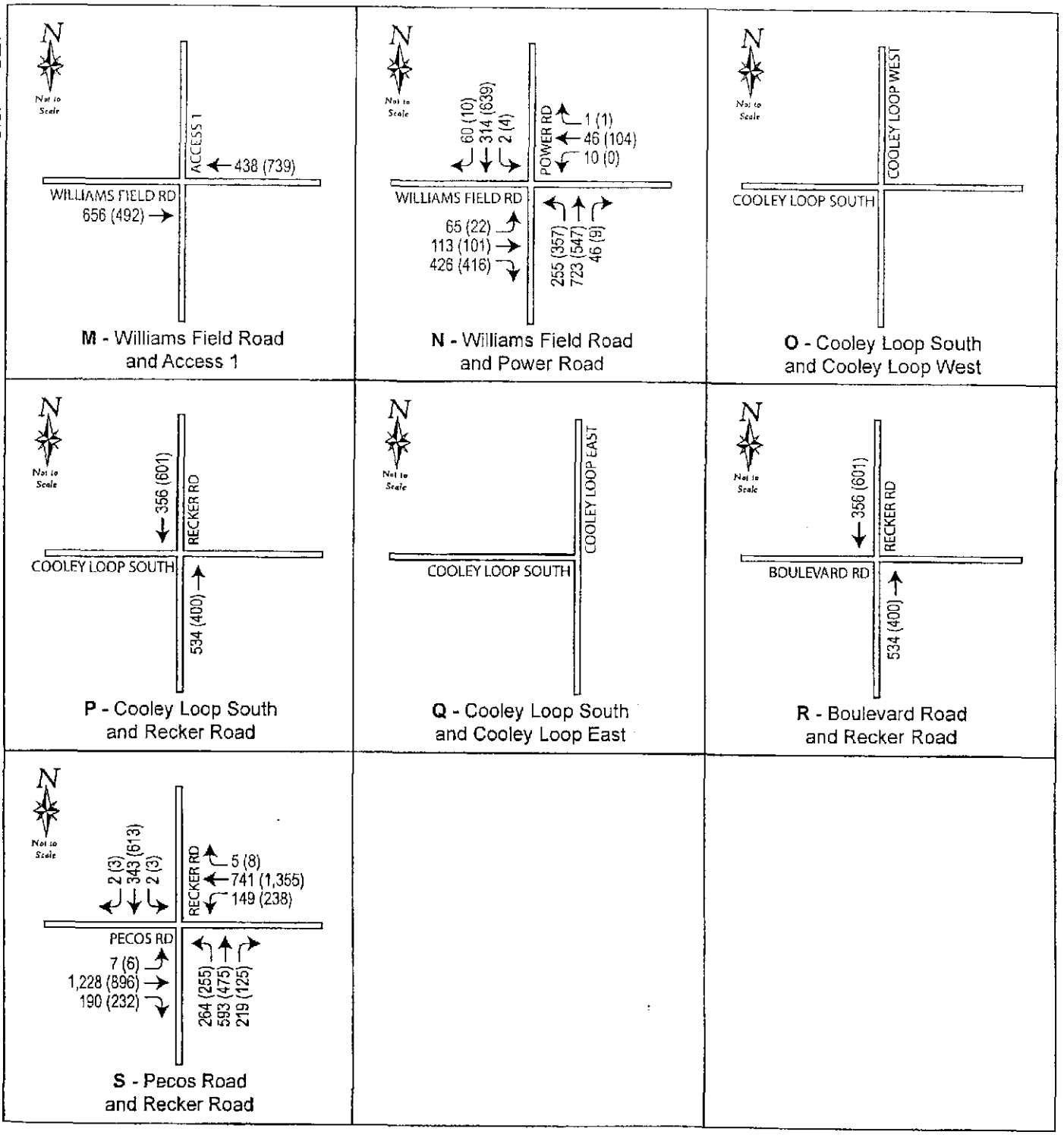
LEGEND:

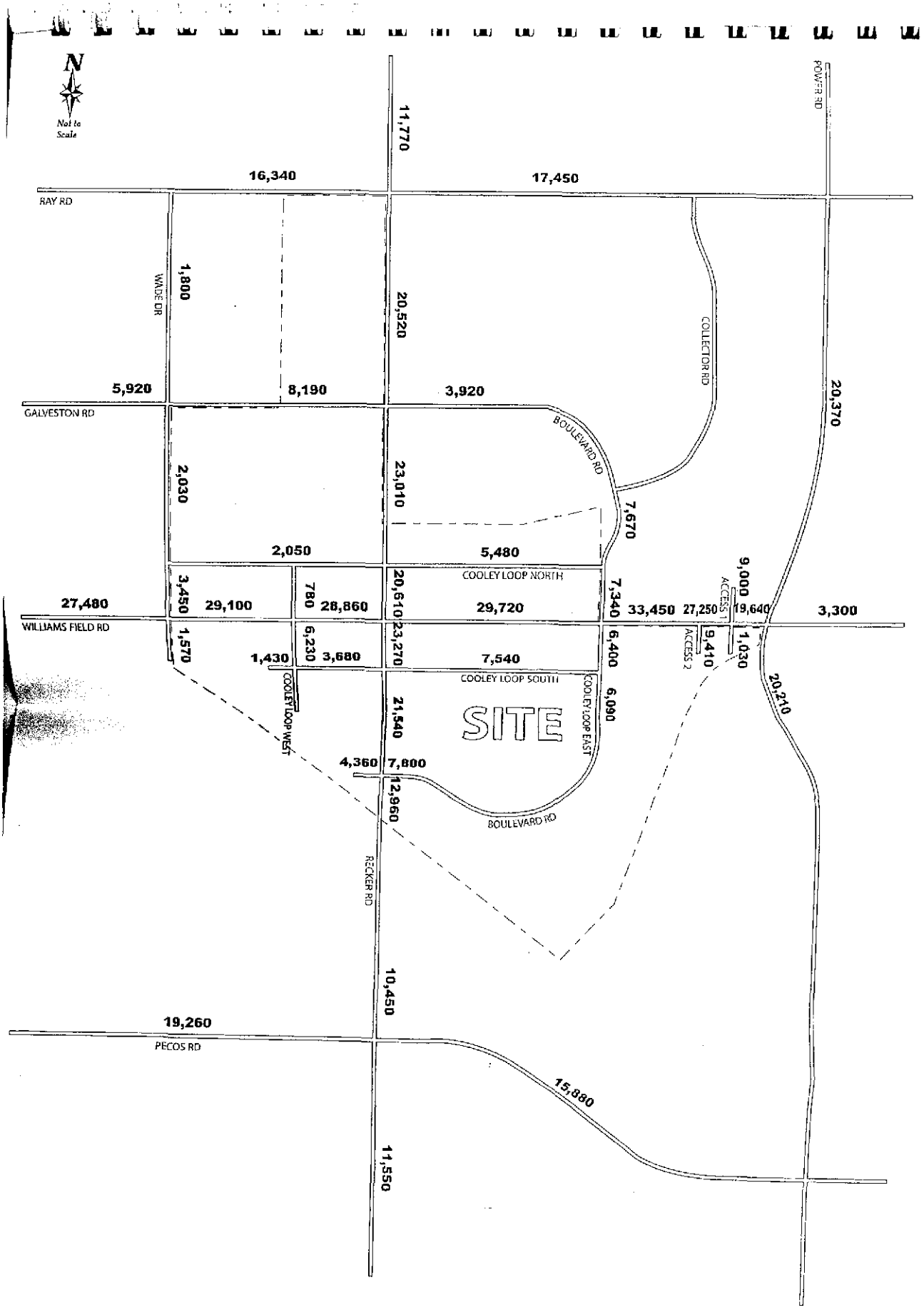
Z : Average Daily Traffic (in bold font)

TASK ENGINEERING

Average Daily Background Traffic
(Year 2025)


N
Not to Scale
6 (9)
319 (574)
315 (339)
RECKER RD
359 (432)
418 (687)
4 (6)
RAY RD
35 (3)
406 (280)
5 (3)
5 (3)
377 (183)
101 (124)
A - Ray Road and Recker Road
GALVESTON RD
WADE DR
B - Galveston Road and Wade Drive
297 (500)
RECKER RD
GALVESTON RD
445 (334)
C - Galveston Road and Recker Road
BOULEVARD RD
COLLECTOR RD
D - Collector Road and Boulevard Road
COOLEY LOOP NORTH
COOLEY LOOP WEST
E - Cooley Loop North and Cooley Loop West
297 (500)
RECKER RD
COOLEY LOOP NORTH
445 (334)
F - Cooley Loop North and Recker Road
BOULEVARD RD
COOLEY LOOP NORTH
G - Cooley Loop North and Boulevard Road
WADE DR
407 (686)
WILLIAMS FIELD RD
610 (458)
H - Williams Field Road and Wade Drive
COOLEY LOOP WEST
407 (686)
WILLIAMS FIELD RD
610 (458)
I - Williams Field Road and Cooley Loop West
2 (31)
269 (445)
26 (26)
RECKER RD
2 (32)
389 (674)
43 (35)
WILLIAMS FIELD RD
3 (20)
564 (417)
41 (24)
21 (29)
454 (354)
57 (19)
J - Williams Field Road and Recker Road
COOLEY LOOP EAST
438 (739)
WILLIAMS FIELD RD
656 (492)
K - Williams Field Road and Cooley Loop East
ACCESS 2
438 (739)
WILLIAMS FIELD RD
656 (492)
L - Williams Field Road and Access 2


N
Not to Scale
ACCESS 1
438 (739)
WILLIAMS FIELD RD
656 (492)
M - Williams Field Road and Access 1
60 (10)
314 (639)
2 (4)
POWER RD
1 (1)
46 (104)
10 (0)
WILLIAMS FIELD RD
65 (22)
113 (101)
426 (416)
255 (357)
723 (547)
46 (9)
N - Williams Field Road and Power Road
COOLEY LOOP WEST
COOLEY LOOP SOUTH
O - Cooley Loop South and Cooley Loop West
356 (601)
RECKER RD
COOLEY LOOP SOUTH
534 (400)
P - Cooley Loop South and Recker Road
COOLEY LOOP EAST
COOLEY LOOP SOUTH
Q - Cooley Loop South and Cooley Loop East
356 (601)
RECKER RD
BOULEVARD RD
534 (400)
R - Boulevard Road and Recker Road
2 (3)
343 (613)
2 (3)
RECKER RD
5 (8)
741 (1,355)
149 (238)
PECOS RD
7 (6)
1,228 (896)
190 (232)
264 (255)
593 (475)
219 (125)
S - Pecos Road and Recker Road



LEGEND:
Z : Average Daily Traffic (in bold font)

TASK ENGINEERING

Average Daily Total Traffic
(Year 2015)

Cooley Station Traffic Impact Study
Figure 9
Page 23
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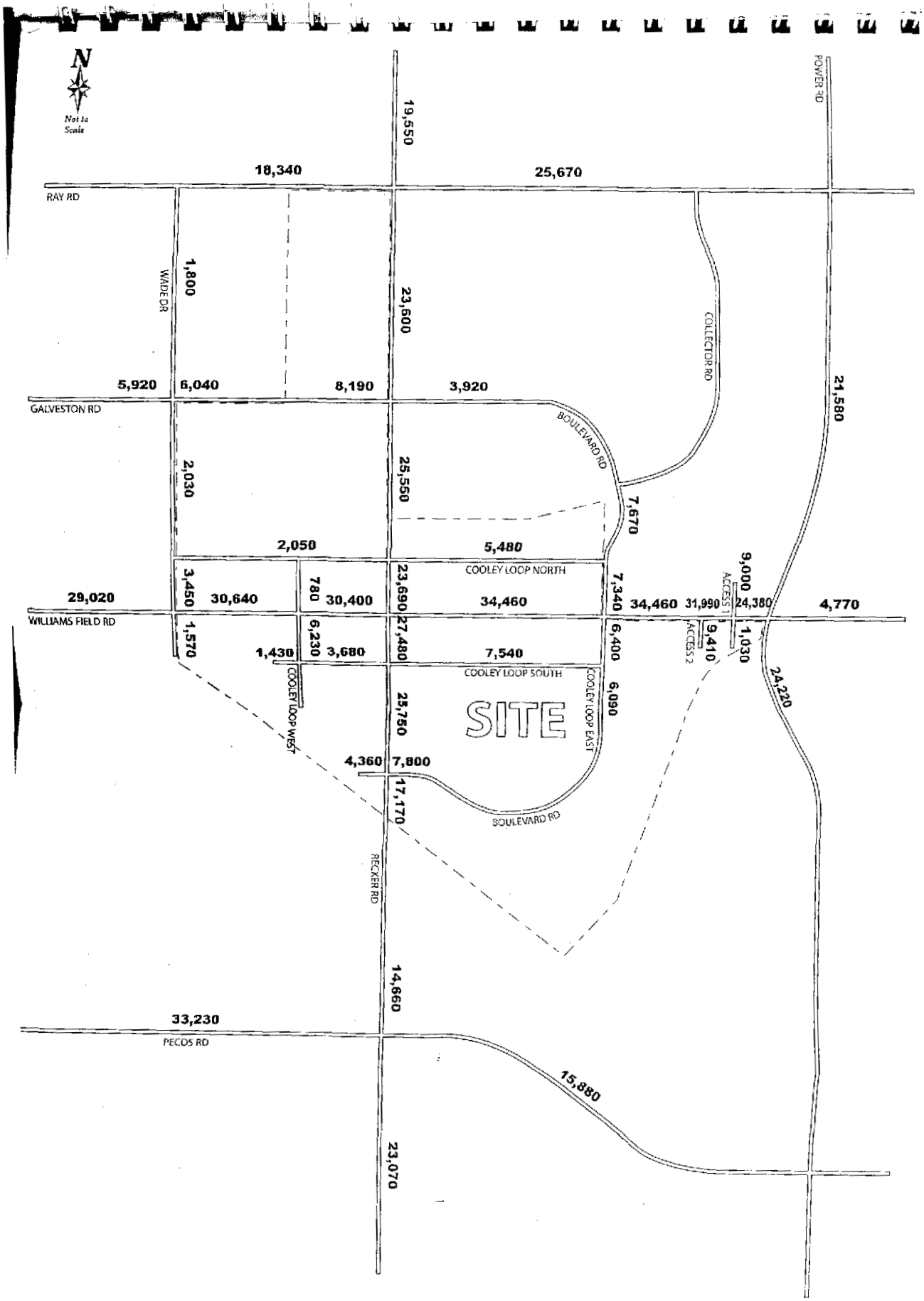
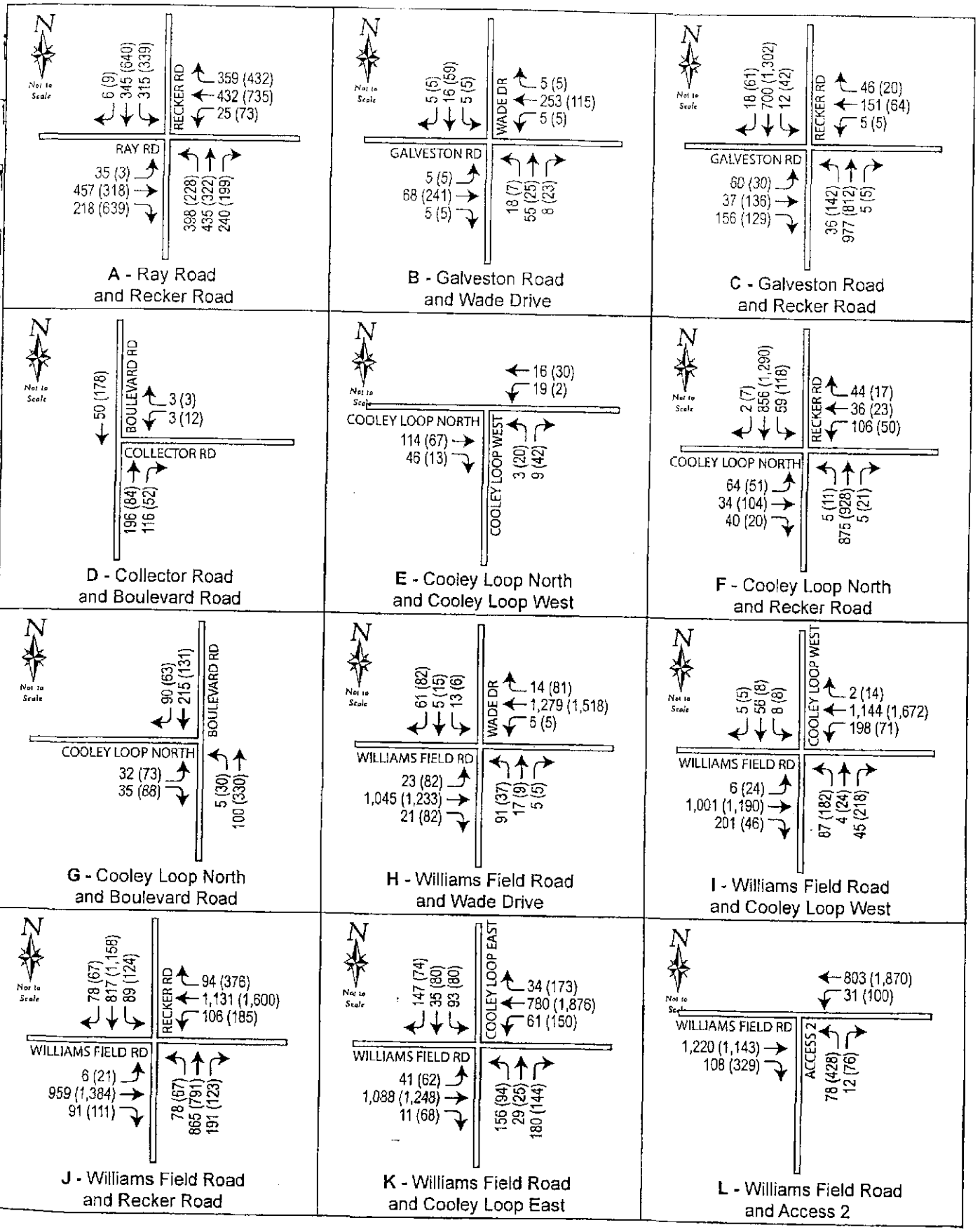


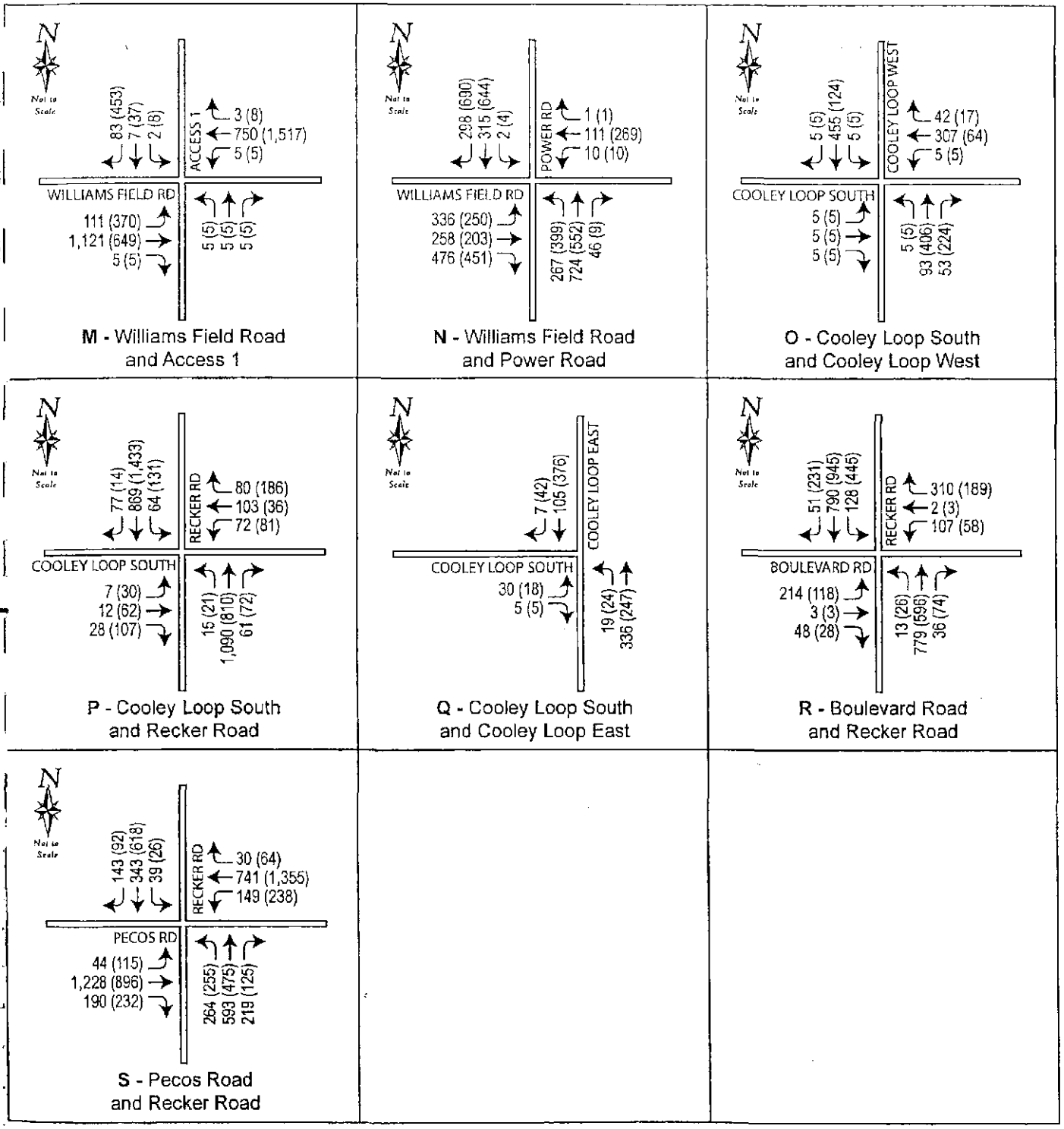
LEGEND

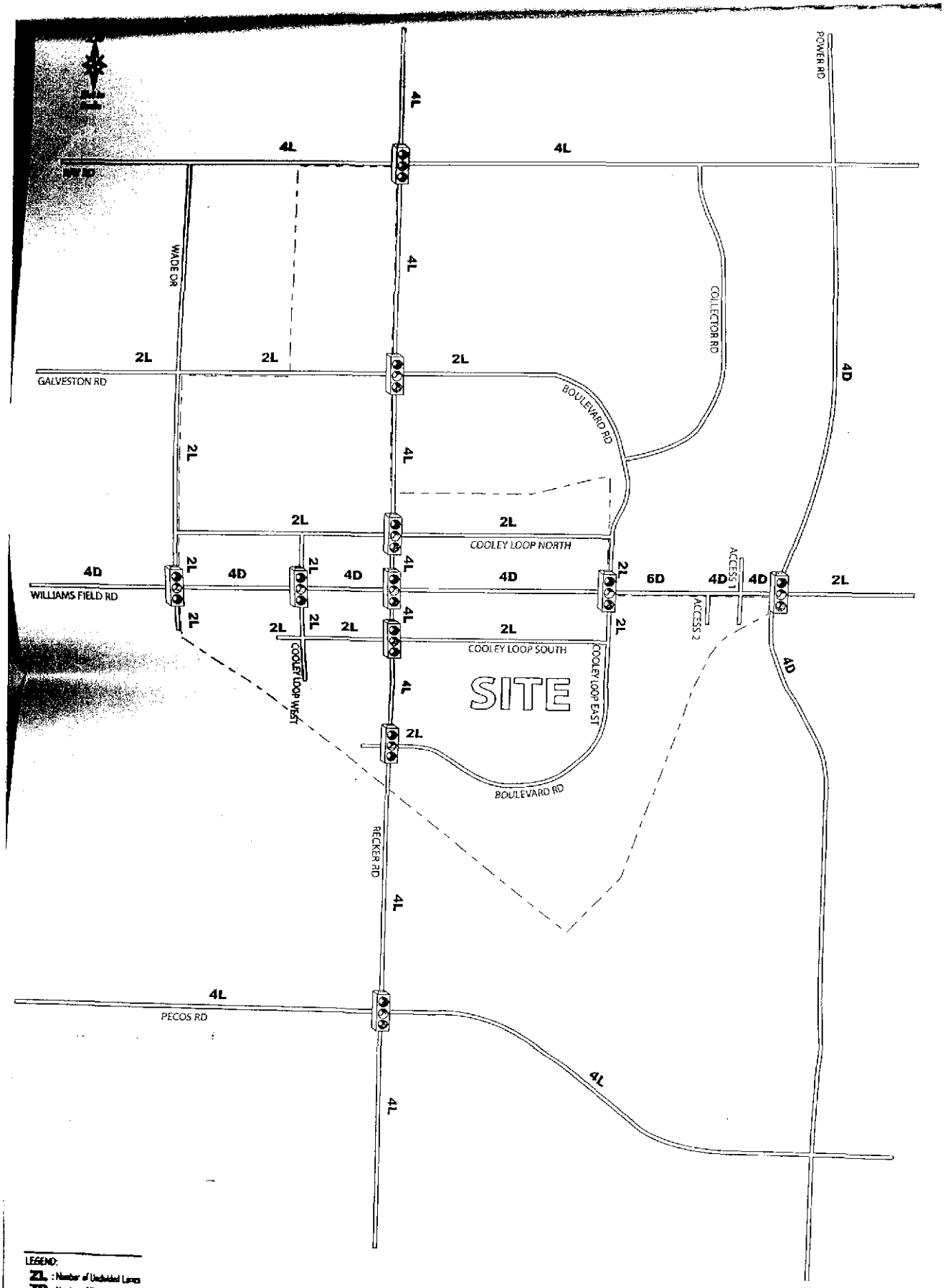
Z : Average Daily Traffic (in bold font)

TASK ENGINEERING

Average Daily Total Traffic
(Year 2025)


N
Not to Scale
RECKER RD
RAY RD
6 (9)
345 (640)
315 (339)
359 (432)
432 (735)
25 (73)
35 (3)
457 (318)
218 (639)
398 (228)
435 (322)
240 (199)
A - Ray Road and Recker Road
WADE DR
GALVESTON RD
5 (6)
16 (59)
5 (5)
5 (5)
253 (115)
5 (5)
5 (5)
68 (241)
5 (5)
18 (7)
55 (25)
8 (23)
B - Galveston Road and Wade Drive
RECKER RD
GALVESTON RD
18 (61)
700 (1,302)
12 (42)
46 (20)
151 (64)
5 (5)
60 (30)
37 (136)
156 (129)
35 (142)
977 (812)
5 (5)
C - Galveston Road and Recker Road
BOULEVARD RD
COLLECTOR RD
50 (178)
3 (3)
3 (12)
196 (84)
116 (52)
D - Collector Road and Boulevard Road
COOLEY LOOP NORTH
COOLEY LOOP WEST
16 (30)
19 (2)
114 (67)
46 (13)
3 (20)
9 (42)
E - Cooley Loop North and Cooley Loop West
RECKER RD
COOLEY LOOP NORTH
2 (7)
856 (1,290)
59 (118)
44 (17)
36 (23)
106 (50)
64 (51)
34 (104)
40 (20)
5 (11)
875 (928)
5 (21)
F - Cooley Loop North and Recker Road
BOULEVARD RD
COOLEY LOOP NORTH
90 (63)
215 (131)
32 (73)
35 (68)
5 (30)
100 (330)
G - Cooley Loop North and Boulevard Road
WADE DR
WILLIAMS FIELD RD
61 (82)
5 (15)
13 (6)
14 (81)
1,279 (1,518)
5 (5)
23 (82)
1,045 (1,233)
21 (82)
91 (37)
17 (9)
5 (5)
H - Williams Field Road and Wade Drive
COOLEY LOOP WEST
WILLIAMS FIELD RD
5 (5)
56 (8)
8 (8)
2 (14)
1,144 (1,672)
198 (71)
6 (24)
1,001 (1,190)
201 (46)
87 (182)
4 (24)
45 (218)
I - Williams Field Road and Cooley Loop West
RECKER RD
WILLIAMS FIELD RD
78 (67)
817 (1,158)
89 (124)
94 (376)
1,131 (1,600)
106 (185)
6 (21)
959 (1,384)
91 (111)
78 (67)
865 (791)
191 (123)
J - Williams Field Road and Recker Road
COOLEY LOOP EAST
WILLIAMS FIELD RD
147 (74)
35 (80)
93 (80)
34 (173)
780 (1,876)
61 (150)
41 (62)
1,088 (1,248)
11 (68)
156 (94)
29 (25)
180 (144)
K - Williams Field Road and Cooley Loop East
WILLIAMS FIELD RD
ACCESS 2
803 (1,870)
31 (100)
1,220 (1,143)
108 (329)
78 (428)
12 (76)
L - Williams Field Road and Access 2


N
Not to Scale
83 (453)
7 (37)
2 (8)
ACCESS 1
3 (8)
750 (1,517)
5 (5)
WILLIAMS FIELD RD
111 (370)
1,121 (649)
5 (5)
5 (5)
5 (5)
5 (5)
M - Williams Field Road and Access 1
298 (690)
315 (644)
2 (4)
POWER RD
1 (1)
111 (269)
10 (10)
WILLIAMS FIELD RD
336 (250)
258 (203)
476 (451)
267 (399)
724 (552)
46 (9)
N - Williams Field Road and Power Road
5 (5)
455 (124)
5 (5)
COOLEY LOOP WEST
42 (17)
307 (64)
5 (5)
COOLEY LOOP SOUTH
5 (5)
5 (5)
5 (5)
5 (5)
93 (406)
53 (224)
O - Cooley Loop South and Cooley Loop West
77 (14)
869 (1,433)
64 (131)
RECKER RD
80 (186)
103 (36)
72 (81)
COOLEY LOOP SOUTH
7 (30)
12 (62)
28 (107)
15 (21)
1,090 (810)
61 (72)
P - Cooley Loop South and Recker Road
7 (42)
105 (376)
COOLEY LOOP EAST
COOLEY LOOP SOUTH
30 (18)
5 (5)
19 (24)
336 (247)
Q - Cooley Loop South and Cooley Loop East
51 (231)
790 (945)
128 (445)
RECKER RD
310 (189)
2 (3)
107 (58)
BOULEVARD RD
214 (118)
3 (3)
48 (28)
13 (26)
779 (596)
36 (74)
R - Boulevard Road and Recker Road
143 (92)
343 (618)
39 (26)
RECKER RD
30 (64)
741 (1,355)
149 (238)
PECOS RD
44 (115)
1,228 (896)
190 (232)
264 (255)
593 (475)
219 (125)
S - Pecos Road and Recker Road


POWER RD
4L
4L
4L
WADE DR
COLLECTOR RD
2L
2L
2L
GALVESTON RD
BOULEVARD RD
4D
2L
2L
2L
COOLEY LOOP NORTH
4D
4D
4D
4D
6D
4D
2L
WILLIAMS FIELD RD
ACCESS 1
ACCESS 2
2L
2L
2L
2L
COOLEY LOOP SOUTH
COOLEY LOOP WEST
COOLEY LOOP EAST
SITE
2L
BOULEVARD RD
RECKER RD
4L
4L
PECOS RD
4L
4L
LEGEND:
2L : Number of Undivided Lanes
2D : Number of Divided Lanes
: Traffic Signal

Signalized intersection analysis is based on control delay. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The level of service (LOS) criteria for signalized intersection analysis is presented in Table 4. The signalized intersection analysis used a cycle length of 94 seconds.

Unsignalized intersections were analyzed as STOP sign controlled intersections using the unsignalized intersection portion of the HCS 2000 Software. The LOS for the "worst" turning movements is reported for unsignalized intersections. Usually, this is the left turn from the minor street or access drive. The LOS criterion for unsignalized intersections is reported in Table 5.

All unsignalized intersections were analyzed as full access intersections. STOP sign control was set on the minor street approach.

Most of the study intersections will operate at an LOS C or better under future conditions, with two exceptions.

The unsignalized intersection of Cooley Loop South and Cooley Loop West experiences an LOS E in the morning peak hour for northbound left turns. In addition, the signalized intersection of Williams Field Road and Recker Road experiences an LOS D in the evening peak hour.

The resulting levels of service are shown on Figure 13 for Year 2025 conditions. HCS worksheet summaries are included in Appendix A.

Table 4
Level of Service Criteria for Signalized Intersections
Cooley Station Traffic Impact Study

Level of Service	Control Delay (sec./veh.)
A	≤ 10.0
B	> 10.0 and ≤ 20.0
C	> 20.0 and ≤35.0
D	> 35.0 and ≤ 55.0
E	> 55.0 and ≤ 80.0
F	> 80.0

Source: Exhibit 16-2, *Highway Capacity Manual 2000*, Transportation Research Board

Table 5
Level of Service Criteria for Unsignalized Intersections
Cooley Station Traffic Impact Study

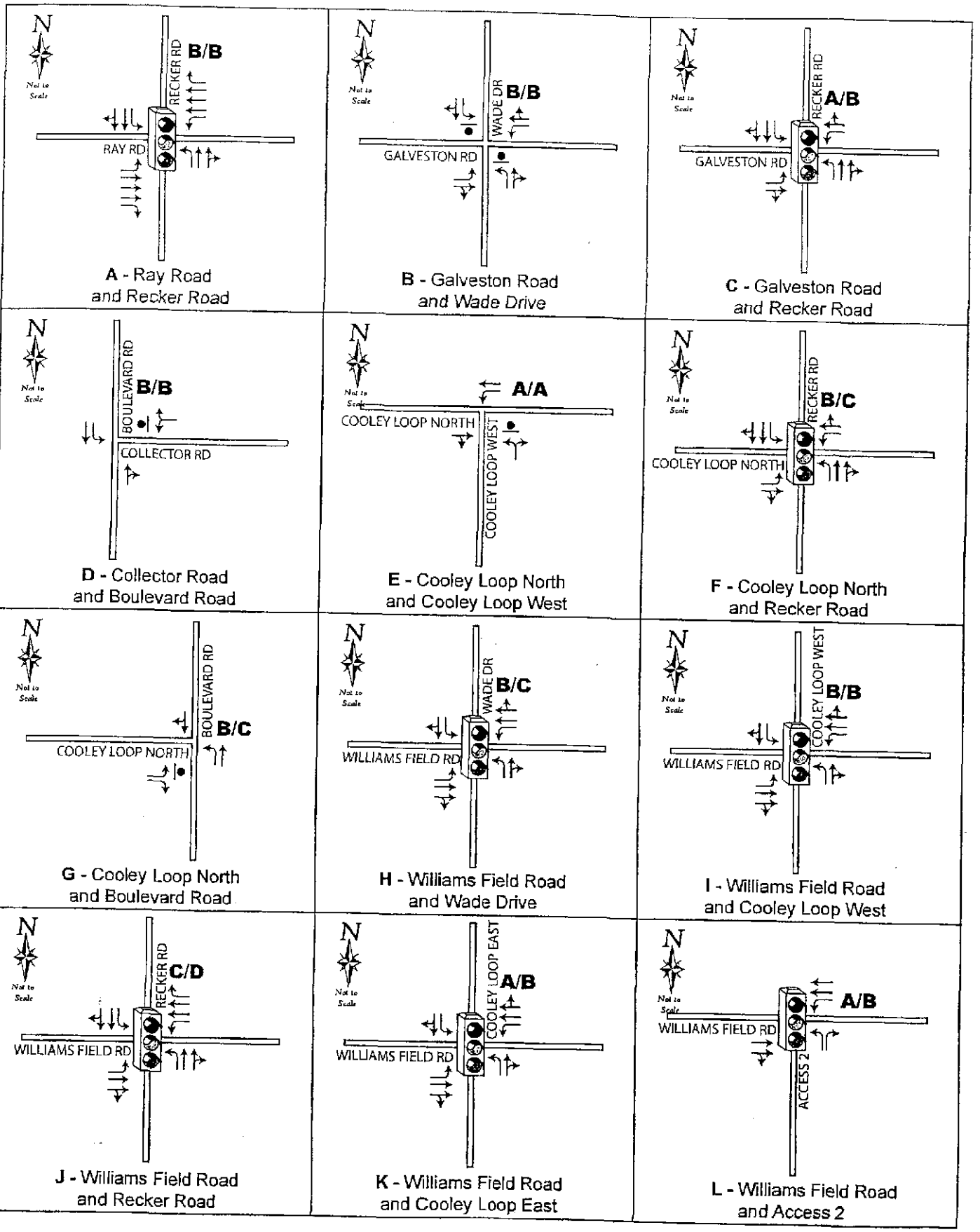
Level of Service	Control Delay (sec./veh.)
A	≤ 10.0
B	> 10.0 and ≤ 15.0
C	> 15.0 and ≤25.0
D	> 25.0 and ≤ 35.0
E	> 35.0 and ≤ 50.0
F	>50.0

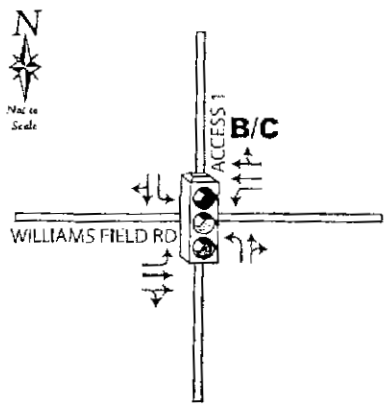
Source: *Exhibit 17-2, Highway Capacity Manual 2000*, Transportation Research Board.

DESIGN ISSUES

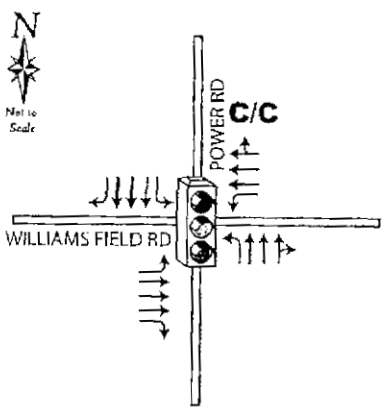
Proposed Roundabouts

Roundabouts are proposed at several locations throughout the Cooley Station development, including several located along Boulevard Road between Cooley Loop South and Recker Road. All are on local or collector streets. If the outside radius of the circular roadway is between 100 and 110 feet, the roundabouts will provide adequate capacity, improved safety and trucks and fire trucks will be able to maneuver through them.

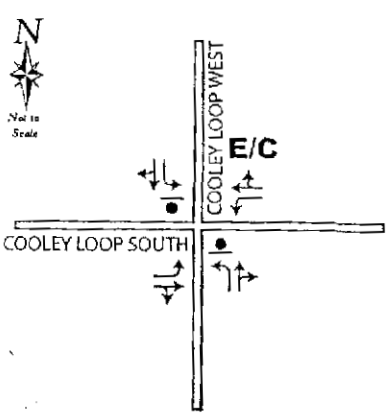

N
Not to Scale
RECKER RD
B/B
RAY RD
A - Ray Road and Recker Road
WADE DR
B/B
GALVESTON RD
B - Galveston Road and Wade Drive
RECKER RD
A/B
GALVESTON RD
C - Galveston Road and Recker Road
BOULEVARD RD
B/B
COLLECTOR RD
D - Collector Road and Boulevard Road
A/A
COOLEY LOOP NORTH
COOLEY LOOP WEST
E - Cooley Loop North and Cooley Loop West
RECKER RD
B/C
COOLEY LOOP NORTH
F - Cooley Loop North and Recker Road
BOULEVARD RD
B/C
COOLEY LOOP NORTH
G - Cooley Loop North and Boulevard Road
WADE DR
B/C
WILLIAMS FIELD RD
H - Williams Field Road and Wade Drive
COOLEY LOOP WEST
B/B
WILLIAMS FIELD RD
I - Williams Field Road and Cooley Loop West
RECKER RD
C/D
WILLIAMS FIELD RD
J - Williams Field Road and Recker Road
COOLEY LOOP EAST
A/B
WILLIAMS FIELD RD
K - Williams Field Road and Cooley Loop East
A/B
WILLIAMS FIELD RD
ACCESS 2
L - Williams Field Road and Access 2



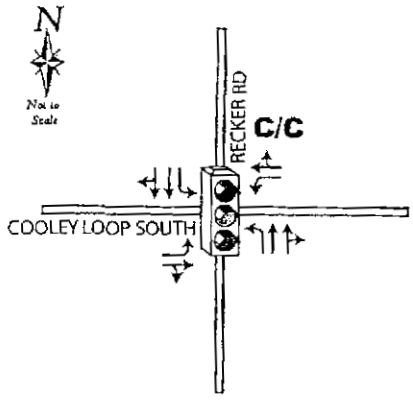
M - Williams Field Road and Access 1



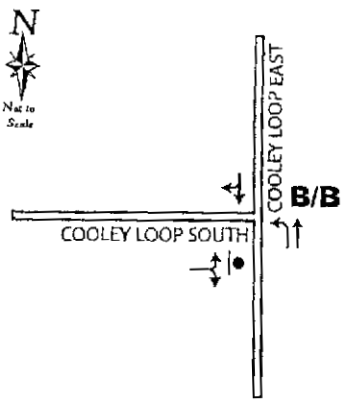
N - Williams Field Road and Power Road



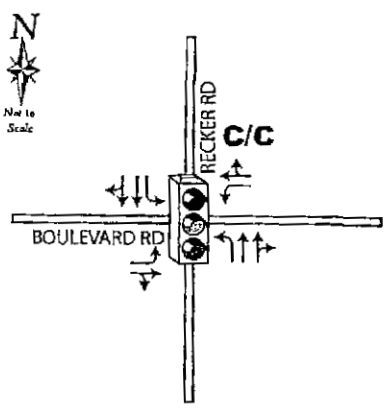
O - Cooley Loop South and Cooley Loop West



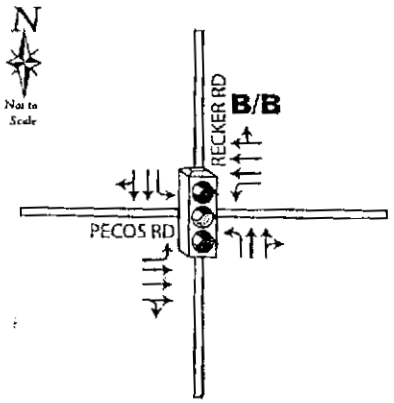
P - Cooley Loop South and Recker Road



Q - Cooley Loop South and Cooley Loop East



R - Boulevard Road and Recker Road



S - Pecos Road and Recker Road

Right Turn Lanes

Right turn deceleration lanes are justified at the following locations due to high volumes of right turns:

- Power Road at Williams Field Road (southbound to westbound and eastbound to southbound)
- Recker Road at Ray Road (westbound to northbound and eastbound to southbound).

These are right turn lanes at signalized intersections that will experience high peak hour turning volumes and for which the right turn lanes result in an overall reduction in delay.

SIGNAL WARRANT ANALYSIS

The Maricopa Department of Transportation (MCDOT) has adopted guidelines for determining if traffic signals are warranted on the basis of estimates of average daily traffic (ADT). These are established by Policy/Procedure Guideline 4-4.6. These guidelines extrapolate the traffic signal warrants of the Manual on Uniform Traffic Control Devices (MUTCD) to estimates of total daily volumes. The guidelines are found in Appendix H.

Year 2015

These procedures were utilized with the average daily traffic volumes for Year 2015 at the following intersections:

- Williams Field Road at Cooley Loop East
- Recker Road at Cooley Loop North
- Recker Road at Williams Field Road
- Recker Road at Cooley Loop South
- Recker Road at Boulevard Road
- Williams Field Road at Cooley Loop West

Signal warrants were not completed for the following intersections since signals currently exist at these intersections:

- Recker Road at Ray Road
- Recker Road at Pecos Road
- Williams Field Road at Power Road

Table 6 compares approach volumes and warranting volumes for the above referenced intersections.

Table 6
Traffic Signal Needs Using ADT Volume Warrant (Year 2015)
Cooley Station Traffic Impact Study

Intersection	Williams Field Road at Cooley Loop East	Recker Road at Cooley Loop North	Recker Road at Williams Field Road
Major Street ADT	31,585	21,810	29,290
Major Street Warranting ADT	12,000	12,000	12,000
Minor Street Approach ADT	7,340	5,480	23,270
Minor Street Warranting Volume	3,000	3,000	4,000
Meets Warrant?	Yes	Yes	Yes

Intersection	Recker Road at Cooley Loop South	Williams Field Road at Cooley Loop West	Recker Road at Boulevard Road
Major Street ADT	22,405	28,980	17,250
Major Street Warranting ADT	12,000	12,000	12,000
Minor Street Approach ADT	7,540	6,230	7,800
Minor Street Warranting Volume	3,000	3,000	3,000
Meets Warrant?	Yes	Yes	Yes

As can be seen from Table 6, the following intersections are anticipated to meet traffic signal warrants fro Year 2015 conditions:

- Williams Field Road at Cooley Loop East
- Recker Road at Cooley Loop North
- Recker Road at Williams Field Road
- Recker Road at Cooley Loop South
- Recker Road at Boulevard Road
- Williams Field Road at Cooley Loop West

Year 2025

These procedures were utilized with the average daily traffic volumes for Year 2025 at the following intersections:

- Recker Road at Galveston Road
- Williams Field Road at Wade Drive
- Williams Field Road at Access 2
- Williams Field Road at Access 1

Table 7 compares approach volumes and warranting volumes for the above referenced intersections.

Table 7
Traffic Signal Needs Using ADT Volume Warrant (Year 2025)
Cooley Station Traffic Impact Study

Intersection	Recker Road at Galveston Road	Williams Field Road at Wade Drive
Major Street ADT	24,575	29,830
Major Street Warranting ADT	12,000	12,000
Minor Street Approach ADT	8,190	3,450
Minor Street Warranting Volume	3,000	3,000
Meets Warrant?	Yes	Yes

Intersection	Williams Field Road at Access 1	Williams Field Road at Access 2
Major Street ADT	28,185	33,225
Major Street Warranting ADT	12,000	12,000
Minor Street Approach ADT	9,000	9,410
Minor Street Warranting Volume	3,000	3,000
Meets Warrant?	Yes	Yes

As can be seen from Table 7, the following intersections are anticipated to meet traffic signal warrants fro Year 2025 conditions:

- Recker Road at Galveston Road
- Williams Field Road at Wade Drive
- Williams Field Road at Access 2
- Williams Field Road at Access 1.

RECOMMENDATIONS

The proposed site is a mixed residential and commercial site that will generate an estimated 117,006 total trip ends per day, with 4,373 morning peak hour outbound trips total and 6,100 evening peak hour inbound trips total. The traffic disperses in such a way that it can be accommodated on the internal driveway and connecting arterial system with the following recommended improvements. Recommendations are shown on Figure 12 for Year 2015 and Figure 13 for Year 2025. Town of Gilbert standard cross sections are found in Appendix F.

Year 2015 Conditions:

- The following roadways are recommended to be four-lane, divided roadways for Year 2015:
    - Williams Field Road (west of Cooley Loop East and east of Access 2)
    - Power Road

- Williams Field Road between Cooley Loop East and Access 2 is recommended to have three lanes in each direction.

- The following roadways are recommended to be four-lane roadways for Year 2015 conditions:
    - Ray Road
    - Recker Road

- The following roadways are recommended to be four-lane roadways for Year 2015 conditions:
    - Galveston Road
    - Boulevard Road
    - Wade Drive
    - Cooley Loop
    - Williams Field Road (east of Power Road).

- Locations where traffic signals are expected to be warranted by 2015 are shown on Figure 12, and include the following:
    - Williams Field Road at Cooley Loop East
    - Recker Road at Cooley Loop North
    - Recker Road at Williams Field Road
    - Recker Road at Cooley Loop South
    - Recker Road at Boulevard Road
    - Williams Field Road at Cooley Loop West

Year 2025 Conditions:

- Right turn deceleration lanes are recommended at the following locations:
    - Power Road at Williams Field Road (southbound to westbound and eastbound to southbound)
    - Recker Road at Ray Road (westbound to northbound and eastbound to southbound).

- The internal collector streets should be designed in accordance with the Town of Gilbert design standards.

- Power Road and Ray Road are recommended to be six-lane roadways per the Town of Gilbert standards.

- The proposed roundabouts, including several located along Boulevard Road between Cooley Loop South and Recker Road are recommended to have an outside radius of the circular roadway between 100 and 110 feet. The roundabouts will provide

adequate capacity, improved safety and trucks and fire trucks will be able to maneuver through them.

- Additional traffic signals are recommended at the following locations for Year 2025 (recommendations are shown on Figure 13-1 and Figure 13-2):
    - Recker Road at Galveston Road
    - Williams Field Road at Wade Drive
    - Williams Field Road at Access 2
    - Williams Field Road at Access 1

APPENDIX A:

CAPACITY SUMMARIES

HCS+™ DETAILED REPORT

General Information		Site Information	
alyst	SAD	Intersection	Recker Rd at Ray Road
Agency or Co.	TASK Eng	Area Type	All other areas
ate Performed	11/8/2006	Jurisdiction	Gilbert
ne Period		Analysis Year	
		Project ID	Recker Road at Ray Road AM Pk Hr-2025

lume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
mber of Lanes, N_1	1	3	1	1	3	1	1	2	0	1	2	0
ne Group	L	T	R	L	T	R	L	TR		L	TR	
olume, V (vph)	35	457	218	25	432	359	398	435	240	315	345	6
Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	0
ak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
retimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
tart-up Lost Time, l_1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
tension of Effective Green, e	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
rival Type, AT	3	3	3	3	3	3	3	3		3	3	
ait Extension, UE	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
ering/Metering, I	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		1.000	1.000	
nitial Unmet Demand, Q_b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
ed / Bike / RTOR Volumes	0	0	60	0	0	0	0	0	40	0	0	0
ne Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0	
arking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
arking Maneuvers, N_m												
ses Stopping, Na	0	0	0	0	0	0	0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	Excl. Left	07	08
ning	G = 27.0	G =	G =	G =	G = 25.0	G = 10.4	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y = 4	Y =	Y =
ration of Analysis, T = 0.25						Cycle Length, C = 74.4		

ne Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
usted Flow Rate, v	38	497	172	27	470	390	433	690		342	382	
ne Group Capacity, c	314	1878	586	301	1878	586	655	1158		514	1212	
c Ratio, X	0.12	0.26	0.29	0.09	0.25	0.67	0.66	0.60		0.67	0.32	
al Green Ratio, g/C	0.36	0.36	0.36	0.36	0.36	0.36	0.53	0.34		0.53	0.34	
iform Delay, d_1	15.8	16.7	16.9	15.6	16.6	19.9	16.2	20.5		21.1	18.3	
rogression Factor, PF	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		1.000	1.000	
ay Calibration, k	0.11	0.11	0.11	0.11	0.11	0.24	0.24	0.18		0.24	0.11	
remental Delay, d_2	0.2	0.1	0.3	0.1	0.1	2.9	2.5	0.8		3.3	0.2	
nitial Queue Delay, d_3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
ntrol Delay	16.0	16.8	17.2	15.7	16.7	22.8	18.7	21.3		24.4	18.5	
ne Group LOS	B	B	B	B	B	C	B	C		C	B	
Approach Delay	16.8			19.3			20.3			21.3		
roach LOS	B			B			C			C		
rsection Delay	19.6			X_c = 0.76			Intersection LOS			B		

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Recker Road at Ray Road AM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB	
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH
Lane Group	*L*	*T*	*R*	*L*	*T*	*R*	*L*	*TR*		*L*	*TR*
Initial Queue/Lane	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*
Flow Rate/Lane Group	*38*	*497*	*172*	*27*	*470*	*390*	*433*	*690*		*342*	*382*
Satflow/Lane	*864*	*1900*	*1615*	*830*	*1900*	*1615*	*1238*	*1810*		*971*	*1894*
Capacity/Lane Group	*314*	*1878*	*586*	*301*	*1878*	*586*	*655*	*1158*		*514*	*1212*
Flow Ratio	*0.0*	*0.1*	*0.1*	*0.0*	*0.1*	*0.2*	*0.3*	*0.2*		*0.4*	*0.1*
v/c Ratio	*0.12*	*0.26*	*0.29*	*0.09*	*0.25*	*0.67*	*0.66*	*0.60*		*0.67*	*0.32*
I Factor	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*
Arrival Type	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*		*3*	*3*
Platoon Ratio	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*		*1.00*	*1.00*
PF Factor	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*		*1.00*	*1.00*
Q_1	*0.5*	*2.7*	*2.5*	*0.4*	*2.5*	*6.8*	*4.8*	*6.2*		*3.8*	*3.1*
k_B	*0.3*	*0.5*	*0.4*	*0.3*	*0.5*	*0.4*	*0.5*	*0.5*		*0.4*	*0.5*
Q_2	*0.0*	*0.2*	*0.2*	*0.0*	*0.2*	*0.9*	*0.9*	*0.7*		*0.8*	*0.2*
Q Average	*0.6*	*2.8*	*2.7*	*0.4*	*2.7*	*7.6*	*5.7*	*6.9*		*4.6*	*3.3*
Percentile Back of Queue (95th percentile)											
$f_{B\%}$	*2.1*	*2.0*	*2.0*	*2.1*	*2.0*	*1.9*	*1.9*	*1.9*		*2.0*	*2.0*
Back of Queue	*1.2*	*5.7*	*5.5*	*0.8*	*5.4*	*14.4*	*11.1*	*13.1*		*9.1*	*6.6*
Queue Storage Ratio											
Queue Spacing	*25.0*	*25.0*	*25.0*	*25.0*	*25.0*	*25.0*	*25.0*	*25.0*		*25.0*	*25.0*
Queue Storage	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		*0*	*0*
Average Queue Storage Ratio											
95% Queue Storage Ratio											

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	MG	Intersection	Galveston Rd at Wade Drive
Agency/Co.	TASK Eng	Jurisdiction	Gilbert
Date Performed	8/8/2006	Analysis Year	2025
Analysis Time Period	AM PK Hr-2025		

Project Description: Galveston Road at Wade Drive AM Pk Hr-2025

East/West Street: Galveston Road	North/South Street: Wade Drive
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	5	68	5	5	253	5
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	5	73	5	5	274	5
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	1	1	0
Configuration	L		TR	L		TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	18	55	8	5	16	5
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	19	59	8	5	17	5
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	1	0	1	1	0
Configuration	L		TR	L		TR

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	L		TR	L		TR
v (veh/h)	5	5	19		67	5		22
c (m) (veh/h)	1295	1533	558		586	508		593
v/c	0.00	0.00	0.03		0.11	0.01		0.04
95% queue length	0.01	0.01	0.11		0.38	0.03		0.12
Control Delay (s/veh)	7.8	7.4	11.7		11.9	12.2		11.3
LOS	A	A	B		B	B		B
Approach Delay (s/veh)	--	--	11.9			11.5		
Approach LOS	--	--	B			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	MG	Intersection	Galveston Rd at Wade Drive
Agency/Co.	TASK Eng	Jurisdiction	Gilbert
Date Performed	8/8/2006	Analysis Year	2025
Analysis Time Period	AM PK Hr-2025		

Project Description: Galveston Road at Wade Drive AM Pk Hr-2025

East/West Street: Galveston Road | North/South Street: Wade Drive

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	5	68	5	5	253	5
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	5	73	5	5	274	5
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	1	1	0
Configuration	L		TR	L		TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	18	55	8	5	16	5
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	19	59	8	5	17	5
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	1	0	1	1	0
Configuration	L		TR	L		TR

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	
Lane Configuration	L	L	L		TR	L		
v (veh/h)	5	5	19		67	5		
C (m) (veh/h)	1295	1533	558		586	508		
v/c	0.00	0.00	0.03		0.11	0.01		
95% queue length	0.01	0.01	0.11		0.38	0.03		
Control Delay (s/veh)	7.8	7.4	11.7		11.9	12.2		
LOS	A	A	B		B	B		
Approach Delay (s/veh)	--	--	11.9			11.5		
Approach LOS	--	--	B			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	MG	Intersection	Galveston Rd at Wade Drive
Agency/Co.	TASK Eng	Jurisdiction	Gilbert
Date Performed	8/8/2006	Analysis Year	2025
Analysis Time Period	PM PK Hr-2025		

Project Description: Galveston Road at Wade Drive PM Pk Hr-2025

East/West Street: Galveston Road	North/South Street: Wade Drive
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	5	241	5	5	115	5
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	5	261	5	5	124	5
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	1	1	0
Configuration	L		TR	L		TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	7	25	23	5	59	5
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	7	27	24	5	64	5
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	1	0	1	1	0
Configuration	L		TR	L		TR

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	L		TR	L		TR
v (veh/h)	5	5	7		51	5		69
C(m) (veh/h)	1469	1310	473		623	496		546
v/c	0.00	0.00	0.01		0.08	0.01		0.13
95% queue length	0.01	0.01	0.05		0.27	0.03		0.43
Control Delay (s/veh)	7.5	7.8	12.7		11.3	12.3		12.5
LOS	A	A	B		B	B		B
Approach Delay (s/veh)	--	--	11.5			12.5		
Approach LOS	--	--	B			B		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	JL	Intersection	Galveston Road/Recker Road
Agency or Co.	TASK Engineering	Area Type	All other areas
Date Performed	11/7/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Galveston Road at Recker Road AM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	0	1	1	0	1	2	0	1	2	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	60	37	156	5	151	46	36	977	5	12	700	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		4	4		4	4	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 19.0	G =	G =	G =	G = 33.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
Adjusted Flow Rate, v	67	214		6	219		40	1092		13	798	
Lane Group Capacity, c	341	529		345	581		351	1988		234	1982	
v/c Ratio, X	0.20	0.40		0.02	0.38		0.11	0.55		0.06	0.40	
Total Green Ratio, g/C	0.32	0.32		0.32	0.32		0.55	0.55		0.55	0.55	
Uniform Delay, d_1	14.9	16.1		14.1	15.9		6.5	8.7		6.3	7.8	
Progression Factor, PF	1.000	1.000		1.000	1.000		0.681	0.681		0.681	0.681	
Delay Calibration, k	0.11	0.11		0.11	0.11		0.11	0.15		0.11	0.11	
Incremental Delay, d_2	0.3	0.5		0.0	0.4		0.1	0.3		0.1	0.1	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	15.2	16.6		14.1	16.3		4.6	6.3		4.4	5.5	
Lane Group LOS	B	B		B	B		A	A		A	A	
Approach Delay	16.3			16.3			6.2			5.4		
Approach LOS	B			B			A			A		
Intersection Delay	8.0			X_c = 0.50			Intersection LOS			A		

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Galveston Road at Recker Road AM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
ane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
itial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
ow Rate/Lane Group	*67*	*214*		*6*	*219*		*40*	*1092*		*13*	*798*	
atflow/Lane	*1076*	*1670*		*1090*	*1834*		*638*	*1898*		*425*	*1892*	
apacity/Lane Group	*341*	*529*		*345*	*581*		*351*	*1988*		*234*	*1982*	
ow Ratio	*0.1*	*0.1*		*0.0*	*0.1*		*0.1*	*0.3*		*0.0*	0.2	
c Ratio	*0.20*	*0.40*		*0.02*	*0.38*		*0.11*	*0.55*		*0.06*	*0.40*	
actor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
rival Type	*3*	*3*		*3*	*3*		*4*	*4*		*4*	*4*	
atoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.33*	*1.33*		*1.33*	*1.33*	
Factor	*1.00*	*1.00*		*1.00*	*1.00*		*0.61*	*0.69*		*0.60*	*0.65*	
	0.8	*2.8*		*0.1*	*2.8*		*0.2*	*4.3*		*0.1*	*2.6*	
	0.3	*0.4*		*0.3*	*0.4*		*0.3*	*0.6*		*0.2*	*0.6*	
	0.1	*0.2*		*0.0*	*0.2*		*0.0*	*0.7*		*0.0*	*0.4*	
Average	*0.9*	*3.0*		*0.1*	*3.1*		*0.2*	*4.9*		*0.1*	*3.0*	

ercentile Back of Queue (95th percentile)

%	*2.1*	2.0		2.1	2.0		2.1	2.0		2.1	2.0	
ack of Queue	*1.8*	*6.1*		*0.2*	*6.2*		*0.5*	*9.6*		*0.2*	*6.1*	

ueue Storage Ratio

ueue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
ueue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
erage Queue Storage Ratio												
% Queue Storage Ratio												

11/8/2006

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	MG	Intersection	Collector Rd at Boulevard Rd
Agency/Co.	TASK Eng	Jurisdiction	Gilbert
Date Performed	8/8/2006	Analysis Year	2025
Analysis Time Period	AM PK Hr-2025		

Project Description: Collector Road at Boulevard Rd AM Pk Hr-2025
East/West Street: Collector Road
Intersection Orientation: East-West
North/South Street: Boulevard Road
Study Period (hrs): 0.25

Vehicle Volumes and Adjustments						
Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)				3		2
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	0	0	0	3	0	2
Percent Heavy Vehicles	0	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration				LTR	LR	
Upstream Signal		0			0	
Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)		196	116	3	50	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	0	213	126	3	54	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	1	1	0
Configuration			TR	L	T	

Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	
Lane Configuration		LTR			TR	L	T	
v (veh/h)		3			339	3	54	
C (m) (veh/h)		1636			955	569	890	
v/c		0.00			0.35	0.01	0.06	
95% queue length		0.01			1.62	0.02	0.19	
Control Delay (s/veh)		7.2			10.8	11.4	9.3	
LOS		A			B	B	A	
Approach Delay (s/veh)	–	–	10.8			9.4		
Approach LOS	–	–	B			A		

Generated: 11/8/20

TWO-WAY STOP CONTROL SUMMARY

neral Information		Site Information	
Analyst	MG	Intersection	Collector Rd at Boulevard Rd
Agency/Co.	TASK Eng	Jurisdiction	Gilbert
te Performed	8/8/2006	Analysis Year	2025
alysis Time Period	PM PK Hr-2025		

Project Description: Collector Road at Boulevard Rd PM Pk Hr-2025

East/West Street: Collector Road	North/South Street: Boulevard Road
rsection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

jor Street	Eastbound			Westbound		
vement	1	2	3	4	5	6
	L	T	R	L	T	R
lume (veh/h)				12		2
ak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
rly Flow Rate, HFR (veh/h)	0	0	0	13	0	2
rcent Heavy Vehicles	0	–	–	0	–	–
dian Type	Undivided					
Channelized			0			0
nes	0	0	0	0	0	0
figuration				LTR	LR	
stream Signal		0			0	

inor Street	Northbound			Southbound		
vement	7	8	9	10	11	12
	L	T	R	L	T	R
lume (veh/h)		84	52	3	178	
eak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
rly Flow Rate, HFR (veh/h)	0	91	56	3	193	0
cent Heavy Vehicles	0	0	0	0	0	0
ercent Grade (%)		0			0	
ed Approach		N			N	
torage		0			0	
T Channelized			0			0
es	0	1	0	1	1	0
figuration			TR	L	T	

Delay, Queue Length, and Level of Service

roach	Eastbound	Westbound	Northbound			Southbound		
vement	1	4	7	8	9	10	11	12
ne Configuration		LTR			TR	L	T	
eh/h)		13			147	3	193	
n) (veh/h)		1636			937	767	863	
		0.01			0.16	0.00	0.22	
queue length		0.02			0.56	0.01	0.86	
ntrol Delay (s/veh)		7.2			9.6	9.7	10.4	
OS		A			A	A	B	
roach Delay (s/veh)	–	–	9.6			10.4		
pproach LOS	–	–	A			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	MG	Intersection	Cooley Loop N./Cooley Loop W.
Agency/Co.	TASK Eng	Jurisdiction	Gilbert
Date Performed	8/8/2006	Analysis Year	2025
Analysis Time Period	AM PK Hr-2025		

Project Description: Cooley Loop North at Cooley Loop West AM Pk Hr-2025

East/West Street: Cooley Loop North | North/South Street: Cooley Loop West

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		114	46	19	16	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	0	123	49	20	17	0
Percent Heavy Vehicles	0	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	1	1	0
Configuration			TR	L	T	
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	3		9			
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	3	0	9	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L		LR				
v (veh/h)		20		12				
C (m) (veh/h)		1417		869				
v/c		0.01		0.01				
95% queue length		0.04		0.04				
Control Delay (s/veh)		7.6		9.2				
LOS		A		A				
Approach Delay (s/veh)	–	–	9.2					
Approach LOS	–	–	A					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
nalyst	MG	Intersection	Cooley Loop N./Cooley Loop W.
Agency/Co.	TASK Eng	Jurisdiction	Gilbert
ate Performed	8/8/2006	Analysis Year	2025
nalysis Time Period	PM PK Hr-2025		

Project Description: Cooley Loop North at Cooley Loop West PM Pk Hr-2025

st/West Street: Cooley Loop North	North/South Street: Cooley Loop West
ersection Orientation: East-West	Study Period (hrs): 0.25

ehicle Volumes and Adjustments

ajor Street	Eastbound			Westbound		
ovement	1	2	3	4	5	6
	L	T	R	L	T	R
lume (veh/h)		67	13	2	30	
eak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
urly Flow Rate, HFR (veh/h)	0	72	14	2	32	0
rcent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
Channelized			0			0
nes	0	1	0	1	1	0
nfiguration			TR	L	T	
stream Signal		0			0	

inor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
lume (veh/h)	20		42			
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
urly Flow Rate, HFR (veh/h)	21	0	45	0	0	0
rcent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
ired Approach		N			N	
Storage		0			0	
RT Channelized			0			0
nes	0	0	0	0	0	0
nfiguration		LR				

Delay, Queue Length, and Level of Service

pproach	Eastbound	Westbound	Northbound			Southbound		
vement	1	4	7	8	9	10	11	12
ne Configuration		L		LR				
veh/h)		2		66				
m) (veh/h)		1523		952				
		0.00		0.07				
% queue length		0.00		0.22				
ntrol Delay (s/veh)		7.4		9.1				
OS		A		A				
proach Delay (s/veh)	--	--	9.1					
pproach LOS	--	--	A					

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	Recker Rd/ Cooley Loop North
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Recker Road at Cooley Loop North AM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB	
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH
Number of Lanes, N_l	1	1	0	1	1	0	1	2	0	1	2
Lane Group	L	TR		L	TR		L	TR		L	TR
Volume, V (vph)	64	34	40	106	36	44	5	875	5	59	856
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Prefimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0
Arrival Type, AT	3	3		3	3		3	3		3	3
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0
Parking Maneuvers, N_m											
Buses Stopping, Nb	0	0		0	0		0	0		0	0
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2	

Phasing	EW Perm	Excl. Left	03	04	NS Perm	Excl. Left	07	08
Timing	G = 25.1	G = 3.0	G =	G =	G = 32.1	G = 5.4	G =	G =
	Y = 4	Y = 0	Y =	Y =	Y = 4	Y = 0	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 73.6		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB	
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH
Adjusted Flow Rate, v	70	80		115	87		5	956		64	932
Lane Group Capacity, c	581	596		588	594		363	1577		355	1577
v/c Ratio, X	0.12	0.13		0.20	0.15		0.01	0.61		0.18	0.59
Total Green Ratio, g/C	0.44	0.34		0.44	0.34		0.56	0.44		0.56	0.44
Uniform Delay, d_1	13.9	16.7		14.2	16.8		15.5	15.9		17.7	15.8
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000
Delay Calibration, k	0.11	0.11		0.11	0.11		0.11	0.19		0.11	0.18
Incremental Delay, d_2	0.1	0.1		0.2	0.1		0.0	0.7		0.2	0.6
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Control Delay	14.0	16.8		14.4	16.9		15.5	16.6		18.0	16.4
Lane Group LOS	B	B		B	B		B	B		B	B
Approach Delay	15.5			15.5			16.6			16.5	
Approach LOS	B			B			B			B	
Intersection Delay	16.4			X_c = 0.38			Intersection LOS			B	

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Recker Road at Cooley Loop North AM Pk Hr-2025*

verage Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
ne Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
itial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
w Rate/Lane Group	*70*	*80*		*115*	*87*		*5*	*956*		*64*	*932*	
tflow/Lane	*1332*	*1747*		*1347*	*1743*		*642*	*1898*		*629*	*1899*	
pacity/Lane Group	*581*	*596*		*588*	*594*		*363*	*1577*		*355*	*1577*	
w Ratio	*0.1*	*0.0*		*0.1*	*0.0*		*0.0*	*0.3*		*0.1*	*0.3*	
Ratio	*0.12*	*0.13*		*0.20*	*0.15*		*0.01*	*0.61*		*0.18*	*0.59*	
actor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
ival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
atoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
	0.8	*1.1*		*1.4*	*1.2*		*0.0*	*7.9*		*0.6*	*7.6*	
	0.4	*0.4*		*0.4*	*0.4*		*0.3*	*0.5*		*0.3*	*0.5*	
	0.1	*0.1*		*0.1*	*0.1*		*0.0*	*0.8*		*0.1*	*0.8*	
Average	*0.9*	*1.2*		*1.5*	*1.3*		*0.0*	*8.7*		*0.7*	*8.4*	

rcentile Back of Queue (95th percentile)

%	*2.1*	*2.1*		*2.1*	*2.1*		*2.1*	*1.9*		*2.1*	*1.9*	
ck of Queue	*1.8*	*2.5*		*3.0*	*2.7*		*0.1*	*16.3*		*1.4*	*15.7*	

ueue Storage Ratio

ieue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
ueue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
erage Queue Storage Ratio												
% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	Recker Rd/ Cooley Loop North
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Recker Road at Cooley Loop North PM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_l	1	1	0	1	1	0	1	2	0	1	2	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	51	104	20	50	23	17	11	928	21	118	1290	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	Excl. Left	03	04	NS Perm	Excl. Left	07	08
Timing	G = 25.1	G = 3.0	G =	G =	G = 32.1	G = 5.4	G =	G =
	Y = 4	Y = 0	Y =	Y =	Y = 4	Y = 0	Y =	Y =
Duration of Analysis, T = 0.25					Cycle Length, C = 73.6			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB	
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH
Adjusted Flow Rate, v	55	135		54	43		12	1032		128	1410
Lane Group Capacity, c	622	632		539	607		334	1573		334	1577
v/c Ratio, X	0.09	0.21		0.10	0.07		0.04	0.66		0.38	0.89
Total Green Ratio, g/C	0.44	0.34		0.44	0.34		0.56	0.44		0.56	0.44
Uniform Delay, d_1	12.9	17.2		14.6	16.4		24.8	16.4		22.3	19.2
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000
Delay Calibration, k	0.11	0.11		0.11	0.11		0.11	0.23		0.11	0.42
Incremental Delay, d_2	0.1	0.2		0.1	0.0		0.0	1.0		0.7	7.0
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Control Delay	13.0	17.4		14.7	16.4		24.8	17.4		23.0	26.2
Lane Group LOS	B	B		B	B		C	B		C	C
Approach Delay	16.1			15.5			17.5			25.9	
Approach LOS	B			B			B			C	
Intersection Delay	21.9			X_c = 0.55			Intersection LOS			C	

BACK-OF-QUEUE WORKSHEET

eneral Information

niect Description *Recker Road at Cooley Loop North PM Pk Hr-2025*

erage Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
e Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
tial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
v Rate/Lane Group	*55*	*135*		*54*	*43*		*12*	*1032*		*128*	*1410*	
tflow/Lane	*1426*	*1854*		*1234*	*1781*		*592*	*1893*		*592*	*1898*	
acity/Lane Group	622	632		539	607		334	*1573*		334	*1577*	
ow Ratio	*0.0*	*0.1*		*0.0*	*0.0*		*0.0*	*0.3*		*0.2*	0.4	
Ratio	*0.09*	*0.21*		*0.10*	*0.07*		*0.04*	*0.66*		*0.38*	*0.89*	
actor	1.000	1.000		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
al Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
atoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
actor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
	0.6	*2.0*		*0.6*	*0.6*		*0.1*	*8.8*		*1.2*	*14.0*	
	0.5	*0.5*		*0.4*	*0.5*		*0.3*	*0.5*		*0.3*	*0.5*	
	0.0	*0.1*		*0.0*	*0.0*		*0.0*	*1.0*		*0.2*	*3.5*	
verage	*0.7*	*2.1*		*0.7*	*0.6*		*0.1*	*9.8*		*1.4*	*17.5*	

centile Back of Queue (95th percentile)

	2.1	*2.0*		*2.1*	*2.1*		*2.1*	*1.8*		*2.1*	*1.7*	
of Queue	*1.4*	*4.2*		*1.4*	*1.3*		*0.3*	*18.1*		*2.9*	*30.2*	

ueue Storage Ratio

ue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
ueue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
rage Queue Storage Ratio												
% Queue Storage Ratio												

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	MG	Intersection	Cooley Loop N. at Boulevard Rd
Agency/Co.	TASK Eng	Jurisdiction	Gilbert
Date Performed	8/8/2006	Analysis Year	2025
Analysis Time Period	AM PK Hr-2025		

Project Description: Cooley Loop North at Boulevard Rd AM Pk Hr-2025

East/West Street: Cooley Loop North | North/South Street: Boulevard Rd

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	32		35			
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	34	0	38	0	0	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	5	100			215	90
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	5	108	0	0	233	97
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	1	0	0	1	0
Configuration	L	T				TR

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L		L	T				TR
v (veh/h)	34		5	108				330
C (m) (veh/h)	1636		499	809				845
v/c	0.02		0.01	0.13				0.39
95% queue length	0.06		0.03	0.46				1.87
Control Delay (s/veh)	7.2		12.3	10.1				12.0
LOS	A		B	B				B
Approach Delay (s/veh)	--	--	10.2			12.0		
Approach LOS	--	--	B			B		

1/8/2006

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	MG	Intersection	
Agency/Co.	TASK Eng	Jurisdiction	Gilbert
Date Performed	8/8/2006	Analysis Year	2025
Analysis Time Period	PM PK Hr-2025		

Project Description: *Cooley Loop North at Boulevard Rd PM Pk Hr-2025*

East/West Street: *Cooley Loop North* | North/South Street: *Boulevard Rd*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	73		88			
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	79	0	95	0	0	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	30	330			131	63
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	32	358	0	0	142	68
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	1	0	0	1	0
Configuration	L	T				TR

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L		L	T				TR
v (veh/h)	79		32	358				210
c (m) (veh/h)	1636		517	702				723
v/c	0.05		0.06	0.51				0.29
95% queue length	0.15		0.20	2.92				1.21
Control Delay (s/veh)	7.3		12.4	15.3				12.0
LOS	A		B	C				B
Approach Delay (s/veh)	--	--	15.1			12.0		
Approach LOS	--	--	C			B		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	Williams Field Rd/Wade Drive
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Williams Field Road at Wade Drive AM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
Number of Lanes, N_1	1	2	0	1	2	0	1	1	0	1	1	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	23	1045	21	5	1279	14	91	17	5	13	5	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	40	0	0	
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 37.2	G =	G =	G =	G = 20.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 65.2		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB	
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH
Adjusted Flow Rate, v	25	1159		5	1405		99	18		14	60
Lane Group Capacity, c	122	2058		192	2061		418	583		435	503
v/c Ratio, X	0.20	0.56		0.03	0.68		0.24	0.03		0.03	0.12
Total Green Ratio, g/C	0.57	0.57		0.57	0.57		0.31	0.31		0.31	0.31
Uniform Delay, d_1	6.8	8.9		6.1	9.8		16.9	15.8		15.8	16.3
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000
Delay Calibration, k	0.11	0.16		0.11	0.25		0.11	0.11		0.11	0.11
Incremental Delay, d_2	0.8	0.4		0.1	0.9		0.3	0.0		0.0	0.1
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Control Delay	7.6	9.2		6.2	10.8		17.2	15.8		15.9	16.4
Lane Group LOS	A	A		A	B		B	B		B	B
Approach Delay	9.2			10.8			17.0			16.3	
Approach LOS	A			B			B			B	
Intersection Delay	10.5			X_c = 0.53			Intersection LOS			B	

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Williams Field Road at Wade Drive AM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
Initial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
Flow Rate/Lane Group	*25*	*1159*		*5*	*1405*		*99*	*18*		*14*	*60*	
Saturation Flow/Lane	*213*	*1894*		*337*	*1897*		*1364*	*1900*		*1417*	*1639*	
Capacity/Lane Group	*122*	*2058*		*192*	*2061*		*418*	*583*		*435*	*503*	
Flow Ratio	*0.1*	*0.3*		*0.0*	*0.4*		*0.1*	*0.0*		*0.0*	0.0	
Ratio	*0.20*	*0.56*		*0.03*	*0.68*		*0.24*	*0.03*		*0.03*	*0.12*	
Factor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
Platoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
N_1	*0.2*	*7.0*		*0.0*	*9.4*		*1.3*	*0.2*		*0.2*	*0.8*	
	0.2	*0.6*		*0.2*	*0.6*		*0.3*	*0.4*		*0.3*	*0.4*	
N_2	*0.0*	*0.8*		*0.0*	*1.2*		*0.1*	*0.0*		*0.0*	*0.1*	
Average	*0.3*	*7.7*		*0.0*	*10.6*		*1.4*	*0.2*		*0.2*	*0.8*	

Percentile Back of Queue (95th percentile)

	2.1	*1.9*		*2.1*	*1.8*		*2.1*	*2.1*		*2.1*	*2.1*	
Back of Queue	*0.5*	*14.6*		*0.1*	*19.5*		*3.0*	*0.5*		*0.4*	*1.7*	

Queue Storage Ratio

Queue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
Queue Storage	*0*	*0*		*0*	0		0	0		*0*	*0*	
Storage Queue Storage Ratio												
95% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	Williams Field Rd/Wade Drive
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Williams Field Road at Wade Drive PM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_l	1	2	0	1	2	0	1	1	0	1	1	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	82	1233	82	5	1518	81	37	9	5	6	15	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	EB Only	03	04	NS Perm	06	07	08
Timing	G = 37.2	G = 5.0	G =	G =	G = 20.0	G =	G =	G =
	Y = 4	Y = 4	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 74.2		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	89	1429		5	1738		40	15		7	105	
Lane Group Capacity, c	321	1797		102	1800		353	487		383	447	
v/c Ratio, X	0.28	0.80		0.05	0.97		0.11	0.03		0.02	0.23	
Total Green Ratio, g/C	0.62	0.50		0.50	0.50		0.27	0.27		0.27	0.27	
Uniform Delay, d_1	26.3	15.3		9.5	17.9		20.4	20.0		19.9	21.1	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k	0.11	0.34		0.11	0.47		0.11	0.11		0.11	0.11	
Incremental Delay, d_2	0.5	2.6		0.2	14.0		0.1	0.0		0.0	0.3	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	26.8	17.9		9.7	31.8		20.6	20.0		19.9	21.4	
Lane Group LOS	C	B		A	C		C	B		B	C	
Approach Delay	18.4			31.8			20.4			21.3		
Approach LOS	B			C			C			C		
Intersection Delay	25.3			X_c = 0.61			Intersection LOS			C		

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Williams Field Road at Wade Drive PM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
Initial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
Flow Rate/Lane Group	*89*	*1429*		*5*	*1738*		*40*	*15*		*7*	*105*	
Outflow/Lane	*516*	*1882*		*204*	*1885*		*1309*	*1805*		*1421*	*1658*	
Capacity/Lane Group	*321*	*1797*		*102*	*1800*		*353*	*487*		*383*	*447*	
Flow Ratio	*0.2*	*0.4*		*0.0*	*0.5*		*0.0*	*0.0*		*0.0*	0.1	
Vc Ratio	*0.28*	*0.80*		*0.05*	*0.97*		*0.11*	*0.03*		*0.02*	*0.23*	
Factor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
Platoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
UF Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
d_1	*0.7*	*12.8*		*0.1*	*18.2*		*0.5*	*0.2*		*0.1*	*1.7*	
d_3	*0.3*	*0.6*		*0.2*	*0.6*		*0.3*	*0.4*		*0.3*	*0.4*	
d_2	*0.1*	*2.1*		*0.0*	*6.4*		*0.0*	*0.0*		*0.0*	*0.1*	
Average	*0.8*	*14.9*		*0.1*	*24.6*		*0.7*	*0.2*		*0.1*	*1.8*	

Percentile Back of Queue (95th percentile)

95%	*2.1*	*1.8*		*2.1*	*1.7*		*2.1*	*2.1*		*2.1*	*2.0*	
Back of Queue	*1.7*	*26.3*		*0.1*	*40.6*		*1.4*	*0.5*		*0.2*	*3.7*	

Queue Storage Ratio

Queue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
Queue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
Average Queue Storage Ratio												
95% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	W. Field Rd/Cooley Loop West
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Williams Field Road at Cooley Loop West AM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_l	1	2	0	1	2	0	1	1	0	1	1	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	6	1001	201	198	1144	2	87	4	45	8	56	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	60	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	WB Only	03	04	NS Perm	06	07	08
Timing	G = 37.2	G = 7.0	G =	G =	G = 25.0	G =	G =	G =
	Y = 4	Y = 4	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 81.2		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
Adjusted Flow Rate, v	7	1241		215	1245		95	53		9	66	
Lane Group Capacity, c	118	1627		338	2147		418	504		423	578	
v/c Ratio, X	0.06	0.76		0.64	0.58		0.23	0.11		0.02	0.11	
Total Green Ratio, g/C	0.46	0.46		0.59	0.59		0.31	0.31		0.31	0.31	
Uniform Delay, d_1	12.3	18.3		27.8	10.2		20.9	20.1		19.6	20.2	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k	0.11	0.31		0.22	0.17		0.11	0.11		0.11	0.11	
Incremental Delay, d_2	0.2	2.2		3.9	0.4		0.3	0.1		0.0	0.1	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	12.5	20.5		31.8	10.6		21.2	20.2		19.6	20.2	
Lane Group LOS	B	C		C	B		C	C		B	C	
Approach Delay	20.5			13.7			20.8			20.2		
Approach LOS	C			B			C			C		
Intersection Delay	17.1			X_c = 0.66			Intersection LOS			B		

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Williams Field Road at Cooley Loop West AM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
ne Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
tial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
w Rate/Lane Group	*7*	*1241*		*215*	*1245*		*95*	*53*		*9*	*66*	
tflow/Lane	*257*	*1865*		*569*	*1899*		*1357*	*1637*		*1373*	*1878*	
pacity/Lane Group	*118*	*1627*		*338*	*2147*		*418*	*504*		*423*	*578*	
w Ratio	*0.0*	*0.3*		*0.4*	*0.3*		*0.1*	*0.0*		*0.0*	0.0	
Ratio	*0.06*	*0.76*		*0.64*	*0.58*		*0.23*	*0.11*		*0.02*	*0.11*	
actor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
ival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
atoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
	0.1	*12.2*		*2.2*	*9.1*		*1.6*	*0.9*		*0.1*	*1.1*	
	0.2	*0.6*		*0.3*	*0.7*		*0.4*	*0.4*		*0.4*	*0.5*	
	0.0	*1.8*		*0.6*	*0.9*		*0.1*	*0.1*		*0.0*	*0.1*	
Average	*0.1*	*14.0*		*2.7*	*10.1*		*1.7*	*0.9*		*0.1*	*1.1*	

rcentile Back of Queue (95th percentile)

%	*2.1*	*1.8*		*2.0*	*1.8*		*2.0*	*2.1*		*2.1*	*2.1*	
ck of Queue	*0.2*	*24.9*		*5.5*	*18.6*		*3.5*	*1.9*		*0.3*	*2.3*	

ueue Storage Ratio

eue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
ueue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
erage Queue Storage Ratio												
% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	W. Field Rd/Cooley Loop West
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Williams Field Road at Cooley Loop West PM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_l	1	2	0	1	2	0	1	1	0	1	1	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	24	1190	46	71	1672	14	182	24	218	8	8	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	40	0	0	0
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	WB Only	03	04	NS Perm	06	07	08
Timing	G = 37.2	G = 7.0	G =	G =	G = 25.0	G =	G =	G =
	Y = 4	Y = 4	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 0.25					Cycle Length, C = 81.2			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
Adjusted Flow Rate, v	26	1343		77	1832		198	219		9	14	
Lane Group Capacity, c	93	1648		338	2145		438	508		308	554	
v/c Ratio, X	0.28	0.81		0.23	0.85		0.45	0.43		0.03	0.03	
Total Green Ratio, g/C	0.46	0.46		0.59	0.59		0.31	0.31		0.31	0.31	
Uniform Delay, d_1	13.7	19.0		23.3	13.6		22.6	22.4		19.6	19.6	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k	0.11	0.36		0.11	0.39		0.11	0.11		0.11	0.11	
Incremental Delay, d_2	1.6	3.3		0.3	3.6		0.7	0.6		0.0	0.0	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	15.3	22.3		23.6	17.2		23.3	23.0		19.7	19.6	
Lane Group LOS	B	C		C	B		C	C		B	B	
Approach Delay	22.2			17.5			23.2			19.6		
Approach LOS	C			B			C			B		
Intersection Delay	19.9			X_c = 0.72			Intersection LOS			B		

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Williams Field Road at Cooley Loop West PM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
Initial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
Flow Rate/Lane Group	*26*	*1343*		*77*	*1832*		*198*	*219*		*9*	*14*	
Saturation Flow/Lane	*204*	*1889*		*569*	*1897*		*1422*	*1649*		*1002*	*1798*	
Capacity/Lane Group	93	*1648*		338	2145		*438*	*508*		*308*	*554*	
Flow Ratio	*0.1*	*0.4*		*0.1*	*0.5*		*0.1*	*0.1*		*0.0*	0.0	
Vc Ratio	*0.28*	*0.81*		*0.23*	*0.85*		*0.45*	*0.43*		*0.03*	*0.03*	
Delay Factor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
Platoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
PF Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
Q_1	*0.4*	*13.8*		*0.7*	*17.9*		*3.6*	*3.9*		*0.1*	*0.2*	
P_0	*0.2*	*0.6*		*0.3*	*0.7*		*0.4*	*0.4*		*0.3*	*0.5*	
Q_2	*0.1*	*2.3*		*0.1*	*3.5*		*0.3*	*0.3*		*0.0*	*0.0*	
Average	*0.4*	*16.1*		*0.8*	*21.4*		*3.9*	*4.3*		*0.2*	*0.2*	

95th percentile Back of Queue (95th percentile)

P95%	*2.1*	*1.7*		*2.1*	*1.7*		*2.0*	*2.0*		*2.1*	*2.1*	
Back of Queue	*0.9*	*28.1*		*1.7*	*36.0*		*7.8*	*8.4*		*0.3*	*0.5*	

Queue Storage Ratio

Queue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
Queue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
Average Queue Storage Ratio												
95% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	Williams Field Rd at Recker Rd
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Williams Field Road at Recker Road AM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	2	0	1	2	1	1	2	0	1	2	
Lane Group	L	TR		L	T	R	L	TR		L	TR	
Volume, V (vph)	6	959	91	106	1131	94	78	865	191	89	817	79
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	0
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3	3	3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000	1.000	1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	10	0	0	10	0	0	10	0	0	10
Lane Width	12.0	12.0		12.0	12.0	12.0	12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0	0	0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	WB Only	03	04	NS Perm	Excl. Left	07	08
Timing	G = 37.2	G = 3.0	G =	G =	G = 36.4	G = 5.4	G =	G =
	Y = 4	Y = 0	Y =	Y =	Y = 4	Y = 0	Y =	Y =

Duration of Analysis, T = 0.25 | Cycle Length, C = 90.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	7	1130		115	1229	91	85	1137		97	962	
Lane Group Capacity, c	84	1478		224	1777	793	286	1425		274	1446	
v/c Ratio, X	0.08	0.76		0.51	0.69	0.11	0.30	0.80		0.35	0.67	
Total Green Ratio, g/C	0.41	0.41		0.49	0.49	0.49	0.51	0.40		0.51	0.40	
Uniform Delay, d_1	16.0	22.6		34.3	17.6	12.3	27.7	23.6		31.8	21.8	
Progression Factor, PF	1.000	1.000		1.000	1.000	1.000	1.000	1.000		1.000	1.000	
Delay Calibration, k	0.11	0.32		0.12	0.26	0.11	0.11	0.34		0.11	0.24	
Incremental Delay, d_2	0.4	2.4		2.0	1.2	0.1	0.6	3.3		0.8	1.2	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay	16.5	25.1		36.3	18.8	12.4	28.3	26.9		32.6	23.0	
Lane Group LOS	B	C		D	B	B	C	C		C	C	
Approach Delay	25.0			19.8			27.0			23.9		
Approach LOS	C			B			C			C		
Intersection Delay	23.7			X_c = 0.84			Intersection LOS			C		

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Williams Field Road at Recker Road AM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
ane Group	*L*	*TR*		*L*	*T*	*R*	*L*	*TR*		*L*	*TR*	
itial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	
ow Rate/Lane Group	*7*	*1130*		*115*	*1229*	*91*	*85*	*1137*		*97*	*962*	
atflow/Lane	*204*	*1877*		*458*	*1900*	*1615*	*562*	*1850*		*537*	*1878*	
apacity/Lane Group	*84*	*1478*		*224*	*1777*	*793*	*286*	*1425*		*274*	*1446*	
ow Ratio	*0.0*	*0.3*		*0.3*	*0.3*	*0.1*	*0.2*	*0.3*		*0.2*	0.3	
c Ratio	*0.08*	*0.76*		*0.51*	*0.69*	*0.11*	*0.30*	*0.80*		*0.35*	*0.67*	
Factor	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	
rival Type	*3*	*3*		*3*	*3*	*3*	*3*	*3*		*3*	*3*	
latoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*	*1.00*	*1.00*	*1.00*		*1.00*	*1.00*	
Factor	*1.00*	*1.00*		*1.00*	*1.00*	*1.00*	*1.00*	*1.00*		*1.00*	*1.00*	
	0.1	*12.7*		*1.5*	*12.4*	*1.2*	*1.1*	*13.1*		*1.2*	*10.3*	
	0.2	*0.6*		*0.3*	*0.7*	*0.6*	*0.3*	*0.6*		*0.3*	*0.6*	
	0.0	*1.8*		*0.3*	*1.4*	*0.1*	*0.1*	*2.1*		*0.2*	*1.1*	
Average	*0.1*	*14.5*		*1.8*	*13.8*	*1.3*	*1.2*	*15.2*		*1.4*	*11.4*	

rcentile Back of Queue (95th percentile)

%	*2.1*	*1.8*		*2.0*	*1.8*	*2.1*	*2.1*	*1.8*		*2.1*	*1.8*	
ck of Queue	*0.3*	*25.6*		*3.7*	*24.6*	*2.7*	*2.5*	*26.7*		*2.9*	*20.7*	

ueue Storage Ratio

eue Spacing	*25.0*	*25.0*		*25.0*	*25.0*	*25.0*	*25.0*	*25.0*		*25.0*	*25.0*	
ueue Storage	*0*	*0*		*0*	*0*	*0*	*0*	*0*		*0*	*0*	
erage Queue Storage Ratio												
% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	Williams Field Rd at Recker Rd
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Williams Field Road at Recker Road PM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	2	0	1	2	1	1	2	0	1	2	
Lane Group	L	TR		L	T	R	L	TR		L	TR	
Volume, V (vph)	21	1384	111	185	1600	376	67	791	123	124	1158	
Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3	3	3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000	1.000	1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	60	0	0	80	0	0	40	0	0	10
Lane Width	12.0	12.0		12.0	12.0	12.0	12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0	0	0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	WB Only	03	04	NS Perm	Excl. Left	07	08
Timing	G = 38.6	G = 5.0	G =	G =	G = 33.3	G = 5.1	G =	G =
	Y = 4	Y = 0	Y =	Y =	Y = 4	Y = 0	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 90.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB	
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH
Adjusted Flow Rate, v	23	1559		201	1739	322	73	950		135	1321
Lane Group Capacity, c	84	1543		265	1914	854	267	1319		267	1329
v/c Ratio, X	0.27	1.01		0.76	0.91	0.38	0.27	0.72		0.51	0.99
Total Green Ratio, g/C	0.43	0.43		0.53	0.53	0.53	0.47	0.37		0.47	0.37
Uniform Delay, d_1	16.6	25.7		36.9	19.2	12.5	34.2	24.3		33.0	28.3
Progression Factor, PF	1.000	1.000		1.000	1.000	1.000	1.000	1.000		1.000	1.000
Delay Calibration, k	0.11	0.50		0.31	0.43	0.11	0.11	0.28		0.11	0.50
Incremental Delay, d_2	1.8	25.5		12.0	6.9	0.3	0.6	1.9		1.6	23.2
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0
Control Delay	18.4	51.2		48.9	26.1	12.8	34.7	26.3		34.6	51.4
Lane Group LOS	B	D		D	C	B	C	C		C	D
Approach Delay	50.7			26.2			26.9			49.9	
Approach LOS	D			C			C			D	
Intersection Delay	37.9			X_c = 0.94			Intersection LOS			D	

BACK-OF-QUEUE WORKSHEET

General Information

oject Description *Williams Field Road at Recker Road PM Pk Hr-2025*

verage Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
ane Group	*L*	*TR*		*L*	*T*	*R*	*L*	*TR*		*L*	*TR*	
itial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		*0.0*	*0.0*	
ow Rate/Lane Group	*23*	*1559*		*201*	*1739*	*322*	*73*	*950*		*135*	*1321*	
tflow/Lane	*197*	*1889*		*501*	*1900*	*1615*	*566*	*1872*		*566*	*1886*	
pacity/Lane Group	*84*	*1543*		*265*	*1914*	*854*	*267*	*1319*		*267*	*1329*	
ow Ratio	*0.1*	*0.4*		*0.4*	*0.5*	*0.2*	*0.1*	*0.3*		*0.2*	*0.4*	
Ratio	*0.27*	*1.01*		*0.76*	*0.91*	*0.38*	*0.27*	*0.72*		*0.51*	*0.99*	
actor	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	
ival Type	*3*	*3*		*3*	*3*	*3*	*3*	*3*		*3*	*3*	
atoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*	*1.00*	*1.00*	*1.00*		*1.00*	*1.00*	
Factor	*1.00*	*1.00*		*1.00*	*1.00*	*1.00*	*1.00*	*1.00*		*1.00*	*1.00*	
	0.4	*20.4*		*2.6*	*20.7*	*4.7*	*1.0*	*10.7*		*1.9*	*17.3*	
	0.2	*0.6*		*0.3*	*0.7*	*0.6*	*0.3*	*0.6*		*0.3*	*0.6*	
	0.1	*8.4*		*0.9*	*4.8*	*0.4*	*0.1*	*1.3*		*0.3*	*6.6*	
verage	*0.4*	*28.9*		*3.4*	*25.5*	*5.1*	*1.1*	*12.0*		*2.2*	*23.9*	

centile Back of Queue (95th percentile)

	2.1	*1.6*		*2.0*	*1.6*	*2.0*	*2.1*	*1.8*		*2.0*	*1.7*	
of Queue	*0.9*	*46.8*		*6.9*	*42.0*	*10.0*	*2.3*	*21.8*		*4.5*	*39.6*	

ueue Storage Ratio

ue Spacing	*25.0*	*25.0*		*25.0*	*25.0*	*25.0*	*25.0*	*25.0*		*25.0*	*25.0*	
ueue Storage	*0*	*0*		*0*	*0*	*0*	*0*	*0*		*0*	*0*	
age Queue Storage Ratio												
%"Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	W. Field Rd/Cooley Loop East
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Williams Field Road at Cooley Loop East AM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	2	0	1	2	0	1	1	0	1	1	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	41	1088	11	61	780	34	156	25	180	93	35	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	WB Only	03	04	NS Perm	06	07	08
Timing	G = 35.0	G = 5.0	G =	G =	G = 20.0	G =	G =	G =
	Y =	Y =	Y =	Y =	Y =	Y =	Y =	Y =

Duration of Analysis, T = 0.25 | Cycle Length, C = 60.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
Adjusted Flow Rate, v	45	1195		66	885		170	223		101	198	
Lane Group Capacity, c	286	2107		312	2397		302	550		281	557	
v/c Ratio, X	0.16	0.57		0.21	0.37		0.56	0.41		0.36	0.36	
Total Green Ratio, g/C	0.58	0.58		0.67	0.67		0.33	0.33		0.33	0.33	
Uniform Delay, d_1	5.7	7.8		10.9	4.4		16.4	15.4		15.1	15.1	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k	0.11	0.16		0.11	0.11		0.16	0.11		0.11	0.11	
Incremental Delay, d_2	0.3	0.4		0.3	0.1		2.4	0.5		0.8	0.4	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	6.0	8.1		11.2	4.5		18.8	15.9		15.9	15.5	
Lane Group LOS	A	A		B	A		B	B		B	B	
Approach Delay	8.1			5.0			17.2			15.7		
Approach LOS	A			A			B			B		
Intersection Delay	9.1			X_c = 0.52			Intersection LOS			A		

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Williams Field Road at Cooley Loop East AM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
Initial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
Flow Rate/Lane Group	*45*	*1195*		*66*	*885*		*170*	*223*		*101*	*198*	
Outflow/Lane	*490*	*1897*		*469*	*1888*		*906*	*1650*		*844*	*1670*	
Capacity/Lane Group	*286*	*2107*		*312*	*2397*		*302*	*550*		*281*	*557*	
Flow Ratio	*0.1*	*0.3*		*0.1*	*0.2*		*0.2*	*0.1*		*0.1*	0.1	
Ratio	*0.16*	*0.57*		*0.21*	*0.37*		*0.56*	*0.41*		*0.36*	*0.36*	
Factor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
Platoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
	0.3	*6.5*		*0.4*	*3.4*		*2.3*	*2.9*		*1.3*	*2.5*	
	0.3	*0.6*		*0.3*	*0.6*		*0.3*	*0.4*		*0.3*	*0.4*	
	0.0	*0.7*		*0.1*	*0.4*		*0.3*	*0.3*		*0.1*	*0.2*	
Average	*0.4*	*7.2*		*0.4*	*3.8*		*2.7*	*3.1*		*1.4*	*2.7*	

Percentile Back of Queue (95th percentile)

	2.1	*1.9*		*2.1*	*2.0*		*2.0*	*2.0*		*2.1*	*2.0*	
% of Queue	*0.8*	*13.8*		*0.9*	*7.5*		*5.4*	*6.3*		*2.9*	*5.5*	

Queue Storage Ratio

Queue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
Queue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
Average Queue Storage Ratio												
95th Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
alyst	MG	Intersection	W. Field Rd/Cooley Loop East
Agency or Co.	TASK Eng	Area Type	All other areas
te Performed	8/8/2006	Jurisdiction	Gilbert
ıe Period		Analysis Year	
		Project ID	Williams Field Road at Cooley Loop East PM Pk Hr-2025

lume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
mber of Lanes, N_1	1	2	0	1	2	0	1	1	0	1	1	
ne Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	62	1248	68	150	1876	173	94	25	144	80	80	
Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	0
ak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
art-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
tension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
lit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
tering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
d / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
ne Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
rking Maneuvers, N_m												
ıses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

hasing	EW Perm	WB Only	03	04	NS Perm	06	07	08
Timing	G = 35.0	G = 5.0	G =	G =	G = 20.0	G =	G =	G =
	Y =	Y =	Y =	Y =	Y =	Y =	Y =	Y =

uration of Analysis, T = 0.25 | Cycle Length, C = 60.0

ne Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
djusted Flow Rate, v	67	1431		163	2227		102	184		87	167	
Lane Group Capacity, c	127	2094		277	2381		328	552		314	588	
v/c Ratio, X	0.53	0.68		0.59	0.94		0.31	0.33		0.28	0.28	
otal Green Ratio, g/C	0.58	0.58		0.67	0.67		0.33	0.33		0.33	0.33	
Uniform Delay, d_1	7.5	8.7		18.6	8.9		14.9	15.0		14.7	14.7	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
elay Calibration, k	0.13	0.25		0.18	0.45		0.11	0.11		0.11	0.11	
Incremental Delay, d_2	4.1	0.9		3.3	7.8		0.5	0.4		0.5	0.3	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
ontrol Delay	11.6	9.6		21.9	16.6		15.4	15.4		15.2	15.0	
Lane Group LOS	B	A		C	B		B	B		B	B	
Approach Delay	9.7			17.0			15.4			15.1		
pproach LOS	A			B			B			B		
Intersection Delay	14.3			X_c = 0.73			Intersection LOS			B		

BACK-OF-QUEUE WORKSHEET

eneral Information

oject Description *Williams Field Road at Cooley Loop East PM Pk Hr-2025*

erage Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
e Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
tial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
w Rate/Lane Group	*67*	*1431*		*163*	*2227*		*102*	*184*		*87*	*167*	
tflow/Lane	*217*	*1885*		*416*	*1876*		*985*	*1657*		*941*	*1763*	
pacity/Lane Group	*127*	*2094*		*277*	*2381*		*328*	*552*		*314*	*588*	
ow Ratio	*0.3*	*0.4*		*0.4*	*0.6*		*0.1*	*0.1*		*0.1*	0.1	
Ratio	*0.53*	*0.68*		*0.59*	*0.94*		*0.31*	*0.33*		*0.28*	*0.28*	
actor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
ival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
atoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
	0.7	*8.7*		*1.0*	*17.2*		*1.3*	*2.3*		*1.1*	*2.0*	
	0.2	*0.6*		*0.3*	*0.6*		*0.3*	*0.4*		*0.3*	*0.4*	
	0.2	*1.2*		*0.3*	*5.7*		*0.1*	*0.2*		*0.1*	*0.2*	
Average	*0.8*	*9.9*		*1.3*	*23.0*		*1.4*	*2.5*		*1.2*	*2.2*	

ercentile Back of Queue (95th percentile)

%	*2.1*	*1.8*		*2.1*	*1.7*		*2.1*	*2.0*		*2.1*	*2.0*	
ck of Queue	*1.7*	*18.2*		*2.7*	*38.3*		*2.9*	*5.0*		*2.4*	*4.5*	

ueue Storage Ratio

eue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
ueue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
erage Queue Storage Ratio												
% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
alyst	MG	Intersection	Williams Field Rd at Access 2
Agency or Co.	TASK Eng	Area Type	All other areas
ıte Performed	8/8/2006	Jurisdiction	Gilbert
ne Period		Analysis Year	
		Project ID	Williams Field Road at Access 2 AM Pk Hr-2025

olume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
umber of Lanes, N_1		2	0	1	2		1		1			
ane Group		TR		L	T		L		R			
Volume, V (vph)		1220	108	31	803		78		12			
Heavy Vehicles, %HV		0	0	0	0		0		0			
eak-Hour Factor, PHF		0.92	0.92	0.92	0.92		0.92		0.92			
Pretimed (P) or Actuated (A)		A	A	A	A		A		A			
tart-up Lost Time, l_1		2.0		2.0	2.0		2.0		2.0			
xtension of Effective Green, e		2.0		2.0	2.0		2.0		2.0			
Arrival Type, AT		3		3	3		3		3			
nit Extension, UE		3.0		3.0	3.0		3.0		3.0			
iltering/Metering, I		1.000		1.000	1.000		1.000		1.000			
Initial Unmet Demand, Q_b		0.0		0.0	0.0		0.0		0.0			
ed / Bike / RTOR Volumes	0	0	0	0	0		0	0	0			
ane Width		12.0		12.0	12.0		12.0		12.0			
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N			
arking Maneuvers, N_m												
uses Stopping, N_B		0		0	0		0		0			
Min. Time for Pedestrians, G_p		3.2			3.2			3.2				

hasing	EW Perm	02	03	04	NB Only	06	07	08
Timing	G = 35.0	G =	G =	G =	G = 20.0	G =	G =	G =
	Y =	Y =	Y =	Y =	Y =	Y =	Y =	Y =
uration of Analysis, T = 0.25						Cycle Length, C = 55.0		

ane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
djusted Flow Rate, v		1443		34	873		85		13			
Lane Group Capacity, c		2274		138	2302		656		587			
v/c Ratio, X		0.63		0.25	0.38		0.13		0.02			
Total Green Ratio, g/C		0.64		0.64	0.64		0.36		0.36			
Uniform Delay, d_1		6.1		4.3	4.8		11.7		11.2			
Progression Factor, PF		1.000		1.000	1.000		1.000		1.000			
Delay Calibration, k		0.21		0.11	0.11		0.11		0.11			
Incremental Delay, d_2		0.6		0.9	0.1		0.1		0.0			
Initial Queue Delay, d_3		0.0		0.0	0.0		0.0		0.0			
Control Delay		6.7		5.2	4.9		11.8		11.2			
Lane Group LOS		A		A	A		B		B			
Approach Delay	6.7			4.9			11.7					
Approach LOS	A			A			B					
Intersection Delay	6.2			X_c = 0.45			Intersection LOS			A		

BACK-OF-QUEUE WORKSHEET

eneral Information

ject Description *Williams Field Road at Access 2 AM Pk Hr-2025*

erage Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
e Group		*TR*		*L*	*T*		*L*		*R*			
ial Queue/Lane		*0.0*		*0.0*	*0.0*		*0.0*		*0.0*			
v Rate/Lane Group		*1443*		*34*	*873*		*85*		*13*			
tflow/Lane		*1877*		*217*	*1900*		*1805*		*1615*			
acity/Lane Group		*2274*		*138*	*2302*		*656*		*587*			
w Ratio		*0.4*		*0.2*	*0.2*		*0.0*		*0.0*			
Ratio		*0.63*		*0.25*	*0.38*		*0.13*		*0.02*			
actor		*1.000*		*1.000*	*1.000*		*1.000*		*1.000*			
val Type		*3*		*3*	*3*		*3*		*3*			
atoon Ratio		*1.00*		*1.00*	*1.00*		*1.00*		*1.00*			
Factor		*1.00*		*1.00*	*1.00*		*1.00*		*1.00*			
		7.0		*0.2*	*3.4*		*0.9*		*0.1*			
		0.6		*0.2*	*0.6*		*0.4*		*0.4*			
		1.0		*0.1*	*0.3*		*0.1*		*0.0*			
verage		*8.0*		*0.3*	*3.7*		*0.9*		*0.1*			
rcentile Back of Queue (95th percentile)												
		1.9		*2.1*	*2.0*		*2.1*		*2.1*			
k of Queue		*15.1*		*0.6*	*7.4*		*1.9*		*0.3*			
ueue Storage Ratio												
eue Spacing		*25.0*		*25.0*	*25.0*		*25.0*		*25.0*			
eue Storage		*0*		*0*	*0*		*0*		*0*			
rage Queue Storage Ratio												
% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	Williams Field Rd at Access 2
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Williams Field Road at Access 2 PM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1		2	0	1	2		1		1			
Lane Group		TR		L	T		L		R			
Volume, V (vph)		1143	329	100	1870		428		76			
% Heavy Vehicles, %HV		0	0	0	0		0		0			
Peak-Hour Factor, PHF		0.92	0.92	0.92	0.92		0.92		0.92			
Pretimed (P) or Actuated (A)		A	A	A	A		A		A			
Start-up Lost Time, l_1		2.0		2.0	2.0		2.0		2.0			
Extension of Effective Green, e		2.0		2.0	2.0		2.0		2.0			
Arrival Type, AT		3		3	3		3		3			
Unit Extension, UE		3.0		3.0	3.0		3.0		3.0			
Filtering/Metering, I		1.000		1.000	1.000		1.000		1.000			
Initial Unmet Demand, Q_b		0.0		0.0	0.0		0.0		0.0			
Ped / Bike / RTOR Volumes	0	0	0	0	0		0	0	0			
Lane Width		12.0		12.0	12.0		12.0		12.0			
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N			
Parking Maneuvers, N_m												
Buses Stopping, N_B		0		0	0		0		0			
Min. Time for Pedestrians, G_p		3.2			3.2			3.2				

Phasing	EW Perm	02	03	04	NB Only	06	07	08
Timing	G = 35.0	G =	G =	G =	G = 20.0	G =	G =	G =
	Y =	Y =	Y =	Y =	Y =	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 55.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		1600		109	2033		465		83			
Lane Group Capacity, c		2225		138	2302		656		587			
v/c Ratio, X		0.72		0.79	0.88		0.71		0.14			
Total Green Ratio, g/C		0.64		0.64	0.64		0.36		0.36			
Uniform Delay, d_1		6.7		7.3	8.3		15.0		11.7			
Progression Factor, PF		1.000		1.000	1.000		1.000		1.000			
Delay Calibration, k		0.28		0.34	0.41		0.27		0.11			
Incremental Delay, d_2		1.2		25.9	4.5		3.5		0.1			
Initial Queue Delay, d_3		0.0		0.0	0.0		0.0		0.0			
Control Delay		7.9		33.2	12.8		18.6		11.9			
Lane Group LOS		A		C	B		B		B			
Approach Delay	7.9			13.8			17.5					
Approach LOS	A			B			B					
Intersection Delay	12.1			X_c = 0.82			Intersection LOS			B		

BACK-OF-QUEUE WORKSHEET

General Information

oject Description *Williams Field Road at Access 2 PM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group		*TR*		*L*	*T*		*L*		*R*			
tial Queue/Lane		*0.0*		*0.0*	*0.0*		*0.0*		*0.0*			
low Rate/Lane Group		*1600*		*109*	*2033*		*465*		*83*			
tflow/Lane		*1836*		*217*	*1900*		*1805*		*1615*			
apacity/Lane Group		*2225*		*138*	*2302*		*656*		*587*			
ow Ratio		*0.5*		*0.5*	*0.6*		*0.3*		*0.1*			
c Ratio		*0.72*		*0.79*	*0.88*		*0.71*		*0.14*			
actor		*1.000*		*1.000*	*1.000*		*1.000*		*1.000*			
rival Type		*3*		*3*	*3*		*3*		*3*			
atoon Ratio		*1.00*		*1.00*	*1.00*		*1.00*		*1.00*			
F Factor		*1.00*		*1.00*	*1.00*		*1.00*		*1.00*			
		8.6		*1.2*	*13.5*		*6.1*		*0.9*			
		0.6		*0.2*	*0.6*		*0.4*		*0.4*			
Q2		*1.4*		*0.5*	*3.6*		*0.9*		*0.1*			
Average		*10.0*		*1.7*	*17.1*		*7.0*		*0.9*			

Percentile Back of Queue (95th percentile)

%		*1.8*		*2.0*	*1.7*		*1.9*		*2.1*			
ack of Queue		*18.4*		*3.5*	*29.6*		*13.4*		*1.9*			

ueue Storage Ratio

ueue Spacing		*25.0*		*25.0*	*25.0*		*25.0*		*25.0*			
ueue Storage		*0*		*0*	*0*		*0*		*0*			
erage Queue Storage Ratio												
% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	Williams Field Rd at Access 1
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Williams Field Road at Access 1 AM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_l	1	2	0	1	2	0	1	1	0	1	1	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	111	1121	5	5	750	3	5	5	5	2	3	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_t	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	EB Only	03	04	NS Perm	06	07	08
Timing	G = 25.0	G = 10.0	G =	G =	G = 20.0	G =	G =	G =
	Y =	Y =	Y =	Y =	Y =	Y =	Y =	Y =

Duration of Analysis, T = 0.25 | Cycle Length, C = 55.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB	
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH
Adjusted Flow Rate, v	121	1223		5	818		5	10		2	93
Lane Group Capacity, c	513	1643		138	1644		436	639		514	591
v/c Ratio, X	0.24	0.74		0.04	0.50		0.01	0.02		0.00	0.16
Total Green Ratio, g/C	0.64	0.45		0.45	0.45		0.36	0.36		0.36	0.36
Uniform Delay, d_1	9.7	12.4		8.3	10.6		11.2	11.2		11.2	11.8
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000
Delay Calibration, k	0.11	0.30		0.11	0.11		0.11	0.11		0.11	0.11
Incremental Delay, d_2	0.2	1.9		0.1	0.2		0.0	0.0		0.0	0.1
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Control Delay	9.9	14.3		8.4	10.8		11.2	11.2		11.2	11.9
Lane Group LOS	A	B		A	B		B	B		B	B
Approach Delay	13.9			10.8			11.2			11.9	
Approach LOS	B			B			B			B	
Intersection Delay	12.7			X_c = 0.40			Intersection LOS			B	

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Williams Field Road at Access 1 AM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
Initial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
Flow Rate/Lane Group	*121*	*1223*		*5*	*818*		*5*	*10*		*2*	*93*	
Outflow/Lane	*806*	*1898*		*304*	*1899*		*1198*	*1758*		*1413*	*1624*	
Capacity/Lane Group	*513*	*1643*		*138*	*1644*		*436*	*639*		*514*	*591*	
Flow Ratio	*0.2*	*0.3*		*0.0*	*0.2*		*0.0*	*0.0*		*0.0*	0.1	
Vc Ratio	*0.24*	*0.74*		*0.04*	*0.50*		*0.01*	*0.02*		*0.00*	*0.16*	
PF Factor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
Platoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
UF Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
N_1	*0.7*	*8.1*		*0.0*	*4.6*		*0.0*	*0.1*		*0.0*	*1.0*	
N_u	*0.3*	*0.5*		*0.2*	*0.5*		*0.3*	*0.4*		*0.3*	*0.4*	
N_2	*0.1*	*1.3*		*0.0*	*0.5*		*0.0*	*0.0*		*0.0*	*0.1*	
Average	*0.8*	*9.4*		*0.0*	*5.1*		*0.1*	*0.1*		*0.0*	*1.0*	

95th percentile Back of Queue (95th percentile)

N95%	*2.1*	*1.9*		*2.1*	*2.0*		*2.1*	*2.1*		*2.1*	*2.1*	
Back of Queue	*1.7*	*17.4*		*0.1*	*9.9*		*0.1*	*0.2*		*0.0*	*2.1*	

Queue Storage Ratio

Queue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
Queue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
Average Queue Storage Ratio												
95% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
alyst	MG	Intersection	Williams Field Rd at Access 1
Agency or Co.	TASK Eng	Area Type	All other areas
te Performed	8/8/2006	Jurisdiction	Gilbert
ne Period		Analysis Year	
		Project ID	Williams Field Road at Access 1 PM Pk Hr-2025

lume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
mber of Lanes, N_1	1	2	0	1	2	0	1	1	0	1	1	
ne Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	370	849	5	5	1517	8	5	5	5	8	37	
Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
ak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
art-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
tension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
it Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
tering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
d / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
ne Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
rking Maneuvers, N_m												
ses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

hasing	EW Perm	EB Only	03	04	NS Perm	06	07	08
Timing	G = 25.0	G = 10.0	G =	G =	G = 20.0	G =	G =	G =
	Y =	Y =	Y =	Y =	Y =	Y =	Y =	Y =

uration of Analysis, T = 0.25 | Cycle Length, C = 55.0

ane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
djusted Flow Rate, v	402	928		5	1658		5	10		9	532	
Lane Group Capacity, c	466	1643		148	1643		138	639		514	595	
v/c Ratio, X	0.86	0.56		0.03	1.01		0.04	0.02		0.02	0.89	
otal Green Ratio, g/C	0.64	0.45		0.45	0.45		0.36	0.36		0.36	0.36	
Uniform Delay, d_1	19.5	11.0		8.3	15.0		11.3	11.2		11.2	16.5	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
elay Calibration, k	0.39	0.16		0.11	0.50		0.11	0.11		0.11	0.42	
Incremental Delay, d_2	15.3	0.5		0.1	24.5		0.1	0.0		0.0	16.0	
nitial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
ontrol Delay	34.8	11.5		8.4	39.5		11.4	11.2		11.2	32.5	
Lane Group LOS	C	B		A	D		B	B		B	C	
Approach Delay	18.5			39.4			11.3			32.1		
pproach LOS	B			D			B			C		
Intersection Delay	30.3			X_c = 0.93			Intersection LOS			C		

11/8/2006

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Williams Field Road at Access 1 PM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
Initial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
Flow Rate/Lane Group	*402*	*928*		*5*	*1658*		*5*	*10*		*9*	*532*	
Outflow/Lane	*733*	*1898*		*325*	*1898*		*380*	*1758*		*1413*	*1636*	
Capacity/Lane Group	*466*	*1643*		*148*	*1643*		*138*	*639*		*514*	*595*	
Flow Ratio	*0.5*	*0.3*		*0.0*	*0.5*		*0.0*	*0.0*		*0.0*	*0.3*	
v/c Ratio	*0.86*	*0.56*		*0.03*	*1.01*		*0.04*	*0.02*		*0.02*	*0.89*	
Factor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
Platoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
UF Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
	2.6	*5.5*		*0.0*	*13.3*		*0.0*	*0.1*		*0.1*	*7.7*	
	0.3	*0.5*		*0.2*	*0.5*		*0.2*	*0.4*		*0.3*	*0.4*	
	1.7	*0.6*		*0.0*	*7.7*		*0.0*	*0.0*		*0.0*	*2.4*	
Average	*4.3*	*6.1*		*0.0*	*21.0*		*0.1*	*0.1*		*0.1*	*10.1*	

Percentile Back of Queue (95th percentile)

%	*2.0*	*1.9*		*2.1*	*1.7*		*2.1*	*2.1*		*2.1*	*1.8*	
Back of Queue	*8.5*	*11.7*		*0.1*	*35.4*		*0.1*	*0.2*		*0.2*	*18.6*	

Queue Storage Ratio

Queue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
Queue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
Average Queue Storage Ratio												
% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	William Field Rd at Power Road
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Williams Field Road at Power Road AM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	3	0	1	3	0	1	3	0	1	3	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	336	258	476	10	111	1	267	724	46	2	315	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	60	0	0	0	0	0	40	0	0	10
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	WB Only	03	04	NS Perm	NB Only	07	08
Timing	G = 37.2	G = 3.0	G =	G =	G = 25.0	G = 10.4	G =	G =
	Y = 4	Y = 0	Y =	Y =	Y = 4	Y = 0	Y =	Y =

Duration of Analysis, T = 0.25 | Cycle Length, C = 83.6

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
Adjusted Flow Rate, v	365	732		11	122		290	794		2	655	
Lane Group Capacity, c	567	2090		390	2733		453	1546		136	1437	
v/c Ratio, X	0.64	0.35		0.03	0.04		0.64	0.51		0.01	0.46	
Total Green Ratio, g/C	0.44	0.44		0.53	0.53		0.47	0.30		0.30	0.30	
Uniform Delay, d_1	18.0	15.3		13.7	9.5		25.7	24.3		20.6	23.8	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k	0.22	0.11		0.11	0.11		0.22	0.12		0.11	0.11	
Incremental Delay, d_2	2.5	0.1		0.0	0.0		3.0	0.3		0.0	0.2	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	20.6	15.4		13.8	9.5		28.7	24.6		20.7	24.0	
Lane Group LOS	C	B		B	A		C	C		C	C	
Approach Delay	17.1			9.9			25.7			24.0		
Approach LOS	B			A			C			C		
Intersection Delay	21.4			X_c = 0.70			Intersection LOS			C		

1/8/2006

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Williams Field Road at Power Road AM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
Initial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
Flow Rate/Lane Group	*365*	*732*		*11*	*122*		*290*	*794*		*2*	*655*	
Satflow/Lane	*1275*	*1723*		*737*	*1897*		*960*	*1897*		*455*	*1763*	
Capacity/Lane Group	*567*	*2090*		*390*	*2733*		*453*	*1546*		*136*	*1437*	
Flow Ratio	*0.3*	*0.2*		*0.0*	*0.0*		*0.3*	*0.2*		*0.0*	0.1	
v/c Ratio	*0.64*	*0.35*		*0.03*	*0.04*		*0.64*	*0.51*		*0.01*	*0.46*	
PF Factor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
Platoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
UF Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
Q_{r1}	*6.6*	*4.1*		*0.1*	*0.5*		*4.0*	*5.6*		*0.0*	*4.5*	
P_0	*0.5*	*0.6*		*0.4*	*0.7*		*0.4*	*0.5*		*0.2*	*0.4*	
Q_{r2}	*0.8*	*0.3*		*0.0*	*0.0*		*0.7*	*0.5*		*0.0*	*0.4*	
Q Average	*7.4*	*4.4*		*0.1*	*0.5*		*4.7*	*6.1*		*0.0*	*4.9*	

Percentile Back of Queue (95th percentile)

N95%	*1.9*	*2.0*		*2.1*	*2.1*		*2.0*	*1.9*		*2.1*	*2.0*	
Back of Queue	*14.1*	*8.7*		*0.3*	*1.1*		*9.2*	*11.7*		*0.1*	*9.6*	

Queue Storage Ratio

Queue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
Queue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
Average Queue Storage Ratio												
95% Queue Storage Ratio												

11/8/2006

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	William Field Rd at Power Road
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Williams Field Road at Power Road PM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	3	0	1	3	0	1	3	0	1	3	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	250	203	451	10	269	1	399	552	9	4	644	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	60	0	0	0	0	0	0	0	0	10
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	NB Only	07	08
Timing	G = 23.0	G =	G =	G =	G = 25.0	G = 13.0	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y = 6	Y =	Y =

Duration of Analysis, T = 0.25 — Cycle Length, C = 75.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
Adjusted Flow Rate, v	272	646		11	293		434	610		4	1439	
Lane Group Capacity, c	329	1431		191	1586		510	2891		252	1592	
v/c Ratio, X	0.83	0.45		0.06	0.18		0.85	0.21		0.02	0.90	
Total Green Ratio, g/C	0.31	0.31		0.31	0.31		0.56	0.56		0.33	0.33	
Uniform Delay, d_1	24.1	20.9		18.4	19.1		24.7	8.2		16.8	23.9	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k	0.36	0.11		0.11	0.11		0.38	0.11		0.11	0.43	
Incremental Delay, d_2	15.8	0.2		0.1	0.1		13.0	0.0		0.0	7.7	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	40.0	21.2		18.5	19.2		37.7	8.3		16.8	31.5	
Lane Group LOS	D	C		B	B		D	A		B	C	
Approach Delay	26.7			19.1			20.5			31.5		
Approach LOS	C			B			C			C		
Intersection Delay	26.2			X_c = 0.89			Intersection LOS			C		

1/8/2006

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Williams Field Road at Power Road PM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
Initial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
Flow Rate/Lane Group	*272*	*646*		*11*	*293*		*434*	*610*		*4*	*1439*	
Satflow/Lane	*1074*	*1712*		*623*	*1899*		*912*	*1895*		*757*	*1753*	
Capacity/Lane Group	*329*	*1431*		*191*	*1586*		*510*	*2891*		*252*	*1592*	
Flow Ratio	*0.3*	*0.1*		*0.0*	*0.1*		*0.5*	*0.1*		*0.0*	*0.3*	
v/c Ratio	*0.83*	*0.45*		*0.06*	*0.18*		*0.85*	*0.21*		*0.02*	*0.90*	
PF Factor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
Platoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
UPF Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
g_1	*5.3*	*4.0*		*0.2*	*1.6*		*4.9*	*2.3*		*0.1*	*10.5*	
g_s	*0.3*	*0.4*		*0.2*	*0.4*		*0.4*	*0.6*		*0.3*	*0.4*	
g_2	*1.3*	*0.3*		*0.0*	*0.1*		*2.0*	*0.2*		*0.0*	*3.0*	
g_a Average	*6.5*	*4.3*		*0.2*	*1.7*		*6.9*	*2.5*		*0.1*	*13.5*	

Percentile Back of Queue (95th percentile)

N95%	*1.9*	*2.0*		*2.1*	*2.0*		*1.9*	*2.0*		*2.1*	*1.8*	
95th Back of Queue	*12.6*	*8.5*		*0.4*	*3.6*		*13.1*	*5.0*		*0.1*	*24.0*	

Queue Storage Ratio

Queue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
Queue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
Average Queue Storage Ratio												
95% Queue Storage Ratio												

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	MG	Intersection	Cooley Loop S./Cooley Loop W.
Agency/Co.	TASK Eng	Jurisdiction	Gilbert
Date Performed	8/8/2006	Analysis Year	2025
Analysis Time Period	AM PK Hr-2025		

Project Description: Cooley Loop South at Cooley Loop West AM Pk Hr-2025

East/West Street: Cooley Loop South | North/South Street: Cooley Loop West

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	5	5	5	5	307	42
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	5	5	5	5	333	45
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	1	1	0
Configuration	L		TR	L		TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	5	93	53	5	455	5
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	5	101	57	5	494	5
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	1	0	1	1	0
Configuration	L		TR	L		TR

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	L		TR	L		T
v (veh/h)	5	5	5		158	5		499
C (m) (veh/h)	1192	1623	85		652	413		548
v/c	0.00	0.00	0.06		0.24	0.01		0.91
95% queue length	0.01	0.01	0.18		0.95	0.04		10.96
Control Delay (s/veh)	8.0	7.2	50.0		12.3	13.8		47
LOS	A	A	E		B	B		E
Approach Delay (s/veh)	--	--	13.4			46.8		
Approach LOS	--	--	B			E		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	MG	Intersection	Cooley Loop S./Cooley Loop W.
Agency/Co.	TASK Eng	Jurisdiction	Gilbert
Date Performed	8/8/2006	Analysis Year	2025
Analysis Time Period	PM PK Hr-2025		

Project Description: Cooley Loop South at Cooley Loop West PM Pk Hr-2025

East/West Street: Cooley Loop South	North/South Street: Cooley Loop West
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	5	5	5	5	64	17
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	5	5	5	5	69	18
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	1	1	0
Configuration	L		TR	L		TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	5	406	224	5	124	5
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	5	441	243	5	134	5
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	1	0	1	1	0
Configuration	L		TR	L		TR

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	L		TR	L		TR
v (veh/h)	5	5	5		684	5		139
C(m) (veh/h)	1522	1623	680		861	222		787
v/c	0.00	0.00	0.01		0.79	0.02		0.18
95% queue length	0.01	0.01	0.02		8.40	0.07		0.64
Control Delay (s/veh)	7.4	7.2	10.3		23.2	21.6		10.6
LOS	A	A	B		C	C		B
Approach Delay (s/veh)	--	--	23.1			10.9		
Approach LOS	--	--	C			B		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	Recker Rd/Cooley Loop South
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Recker Road at Cooley Loop South AM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	0	1	1	0	1	2	0	1	2	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	7	12	28	72	103	80	15	1090	61	64	869	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	40	0	0	10
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	WB Only	03	04	NS Perm	Excl. Left	07	08
Timing	G = 25.2	G = 3.0	G =	G =	G = 35.0	G = 10.4	G =	G =
	Y = 4	Y = 0	Y =	Y =	Y = 4	Y = 0	Y =	Y =

Duration of Analysis, T = 0.25 — Cycle Length, C = 81.6

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
Adjusted Flow Rate, v	8	43		78	199		16	1208		70	1018	
Lane Group Capacity, c	340	525		559	700		419	1547		412	1535	
v/c Ratio, X	0.02	0.08		0.14	0.28		0.04	0.78		0.17	0.66	
Total Green Ratio, g/C	0.31	0.31		0.39	0.39		0.61	0.43		0.61	0.43	
Uniform Delay, d_1	19.6	20.0		16.7	16.8		17.0	20.0		22.3	18.6	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k	0.11	0.11		0.11	0.11		0.11	0.33		0.11	0.24	
Incremental Delay, d_2	0.0	0.1		0.1	0.2		0.0	2.7		0.2	1.1	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	19.7	20.1		16.9	17.1		17.0	22.7		22.5	19.7	
Lane Group LOS	B	C		B	B		B	C		C	B	
Approach Delay	20.0			17.0			22.6			19.9		
Approach LOS	C			B			C			B		
Intersection Delay	20.8			X_c = 0.47			Intersection LOS			C		

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Recker Road at Cooley Loop South AM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
Initial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
Flow Rate/Lane Group	*8*	*43*		*78*	*199*		*16*	*1208*		*70*	*1018*	
Satflow/Lane	*1100*	*1701*		*1417*	*1775*		*692*	*1894*		*680*	*1879*	
Capacity/Lane Group	*340*	*525*		*559*	*700*		*419*	*1547*		*412*	*1535*	
Flow Ratio	*0.0*	*0.0*		*0.1*	*0.1*		*0.0*	*0.3*		*0.1*	0.3	
v/c Ratio	*0.02*	*0.08*		*0.14*	*0.28*		*0.04*	*0.78*		*0.17*	*0.66*	
Factor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
Platoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
PF Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
Q_1	*0.1*	*0.7*		*1.1*	*3.1*		*0.1*	*12.3*		*0.6*	*9.7*	
I_{p2}	*0.3*	*0.4*		*0.5*	*0.5*		*0.4*	*0.6*		*0.4*	*0.6*	
Q_2	*0.0*	*0.0*		*0.1*	*0.2*		*0.0*	*1.9*		*0.1*	*1.1*	
Average	*0.1*	*0.7*		*1.2*	*3.3*		*0.2*	*14.2*		*0.7*	*10.7*	

Percentile Back of Queue (95th percentile)

%	*2.1*	*2.1*		*2.1*	*2.0*		*2.1*	*1.8*		*2.1*	*1.8*	
Back of Queue	*0.3*	*1.5*		*2.4*	*6.6*		*0.3*	*25.2*		*1.5*	*19.7*	

Queue Storage Ratio

Queue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
Queue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
Average Queue Storage Ratio												
95% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	Recker Rd/Cooley Loop South
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Recker Road at Cooley Loop South PM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	0	1	1	0	1	2	0	1	2	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	30	62	107	81	36	186	21	810	72	131	1433	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	0
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	60	0	0	0	0	0	40	0	0	10
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	WB Only	03	04	NS Perm	Excl. Left	07	08
Timing	G = 25.2	G = 3.0	G =	G =	G = 35.0	G = 10.4	G =	G =
	Y = 4	Y = 0	Y =	Y =	Y = 4	Y = 0	Y =	Y =

Duration of Analysis, T = 0.25 | Cycle Length, C = 81.6

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
Adjusted Flow Rate, v	33	118		88	241		23	915		142	1562	
Lane Group Capacity, c	306	549		492	655		412	1543		450	1551	
v/c Ratio, X	0.11	0.21		0.18	0.37		0.06	0.59		0.32	1.01	
Total Green Ratio, g/C	0.31	0.31		0.39	0.39		0.61	0.43		0.61	0.43	
Uniform Delay, d_1	20.2	20.9		18.7	17.5		24.8	17.8		19.5	23.3	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k	0.11	0.11		0.11	0.11		0.11	0.18		0.11	0.50	
Incremental Delay, d_2	0.2	0.2		0.2	0.4		0.1	0.6		0.4	24.6	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	20.3	21.1		18.9	17.8		24.8	18.5		19.9	47.9	
Lane Group LOS	C	C		B	B		C	B		B	D	
Approach Delay	20.9			18.1			18.6			45.6		
Approach LOS	C			B			B			D		
Intersection Delay	33.4			X_c = 0.61			Intersection LOS			C		

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Recker Road at Cooley Loop South PM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
Initial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
Flow Rate/Lane Group	*33*	*118*		*88*	*241*		*23*	*915*		*142*	*1562*	
Satflow/Lane	*990*	*1777*		*1246*	*1661*		*680*	*1889*		*743*	*1899*	
Capacity/Lane Group	*306*	*549*		*492*	*655*		*412*	*1543*		*450*	*1551*	
Flow Ratio	*0.0*	*0.1*		*0.1*	*0.1*		*0.0*	*0.3*		*0.2*	0.4	
v/c Ratio	*0.11*	*0.21*		*0.18*	*0.37*		*0.06*	*0.59*		*0.32*	*1.01*	
Factor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
Platoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
PF Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
Q_1	*0.5*	*2.0*		*1.2*	*3.9*		*0.2*	*8.3*		*1.3*	*18.6*	
	0.3	*0.5*		*0.4*	*0.5*		*0.4*	*0.6*		*0.4*	*0.6*	
Q_2	*0.0*	*0.1*		*0.1*	*0.3*		*0.0*	*0.8*		*0.2*	*8.1*	
Average	*0.6*	*2.1*		*1.3*	*4.2*		*0.2*	*9.1*		*1.5*	*26.6*	

Percentile Back of Queue (95th percentile)

%	*2.1*	*2.0*		*2.1*	*2.0*		*2.1*	*1.9*		*2.1*	*1.6*	
Back of Queue	*1.2*	*4.3*		*2.7*	*8.2*		*0.5*	*17.0*		*3.1*	*43.6*	

Queue Storage Ratio

Queue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
Queue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
Average Queue Storage Ratio												
95% Queue Storage Ratio												

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	MG	Intersection	Cooley Loop S./Cooley Loop E.
Agency/Co.	TASK Eng	Jurisdiction	Gilbert
Date Performed	8/8/2006	Analysis Year	2025
Analysis Time Period	AM PK Hr-2025		

Project Description: Cooley Loop South at Cooley Loop East AM Pk Hr-2025

East/West Street: Cooley Loop South	North/South Street: Cooley Loop East
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	30		5			
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	32	0	5	0	0	0
Percent Heavy Vehicles	0	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration	LTR	LR				
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	19	336			105	7
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	20	365	0	0	114	7
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	1	0	0	1	0
Configuration	L	T				TR

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR		L	T				
v (veh/h)	32		20	365				121
C(m) (veh/h)	1636		744	813				821
v/c	0.02		0.03	0.45				0.15
95% queue length	0.06		0.08	2.35				0.52
Control Delay (s/veh)	7.2		10.0	13.0				10.
LOS	A		A	B				B
Approach Delay (s/veh)	–	–	12.8			10.1		
Approach LOS	–	–	B			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	MG	Intersection	Cooley Loop S./Cooley Loop E.
Agency/Co.	TASK Eng	Jurisdiction	Gilbert
Date Performed	8/8/2005	Analysis Year	2025
Analysis Time Period	PM PK Hr-2025		

Project Description: Cooley Loop South at Cooley Loop East PM Pk Hr-2025

East/West Street: Cooley Loop South	North/South Street: Cooley Loop East
Intersection Orientation: East-West	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	18		5			
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	19	0	5	0	0	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration	LTR	LR				
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	24	247			376	42
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	26	268	0	0	408	45
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Shared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	1	0	0	1	0
Configuration	L	T				TR

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR		L	T				TR
v (veh/h)	19		26	268				453
c(m) (veh/h)	1636		407	846				862
v/c	0.01		0.06	0.32				0.53
95% queue length	0.04		0.20	1.37				3.13
Control Delay (s/veh)	7.2		14.4	11.2				13.7
LOS	A		B	B				B
Approach Delay (s/veh)	--	--	11.5			13.7		
Approach LOS	--	--	B			B		

11/8/2006

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	Recker Rd at Boulevard Road
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Recker Road at Boulevard Road AM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	0	1	1	0	1	2	0	2	2	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	214	3	48	58	2	310	13	779	36	128	790	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	10
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	WB Only	03	04	NS Perm	Excl. Left	07	08
Timing	G = 25.2	G = 3.0	G =	G =	G = 35.0	G = 10.4	G =	G =
	Y = 4	Y = 0	Y =	Y =	Y = 4	Y = 0	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 81.6		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
Adjusted Flow Rate, v	233	55		63	339		14	886		139	904	
Lane Group Capacity, c	230	504		548	638		454	1542		1108	1540	
v/c Ratio, X	1.01	0.11		0.11	0.53		0.03	0.57		0.13	0.59	
Total Green Ratio, g/C	0.31	0.31		0.39	0.39		0.61	0.43		0.61	0.43	
Uniform Delay, d_1	28.2	20.2		16.8	18.9		15.0	17.7		15.4	17.8	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k	0.50	0.11		0.11	0.13		0.11	0.17		0.11	0.18	
Incremental Delay, d_2	62.7	0.1		0.1	0.9		0.0	0.5		0.1	0.6	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	90.9	20.3		16.9	19.8		15.0	18.2		15.4	18.4	
Lane Group LOS	F	C		B	B		B	B		B	B	
Approach Delay	77.4			19.3			18.1			18.0		
Approach LOS	E			B			B			B		
Intersection Delay	24.7			X_c = 0.63			Intersection LOS			C		

BACK-OF-QUEUE WORKSHEET

eneral Information

oject Description *Recker Road at Boulevard Road AM Pk Hr-2025*

verage Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
ne Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
tial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
ow Rate/Lane Group	*233*	*55*		*63*	*339*		*14*	*886*		*139*	*904*	
tflow/Lane	*745*	*1631*		*1389*	*1617*		*749*	*1887*		*942*	*1886*	
apacity/Lane Group	*230*	*504*		*548*	*638*		*454*	*1542*		*1108*	*1540*	
ow Ratio	*0.3*	*0.0*		*0.0*	*0.2*		*0.0*	*0.2*		*0.1*	0.3	
Ratio	*1.01*	*0.11*		*0.11*	*0.53*		*0.03*	*0.57*		*0.13*	*0.59*	
actor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
rival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
atoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
	5.3	*0.9*		*0.9*	*5.9*		*0.1*	*8.0*		*0.6*	*8.2*	
	0.3	*0.4*		*0.5*	*0.5*		*0.4*	*0.6*		*0.5*	*0.6*	
	3.0	*0.1*		*0.1*	*0.6*		*0.0*	*0.8*		*0.1*	*0.8*	
Average	*8.3*	*0.9*		*0.9*	*6.4*		*0.1*	*8.7*		*0.7*	*9.0*	
ercentile Back of Queue (95th percentile)												
	1.9	*2.1*		*2.1*	*1.9*		*2.1*	*1.9*		*2.1*	*1.9*	
ck of Queue	*15.5*	*2.0*		*1.9*	*12.4*		*0.3*	*16.4*		*1.5*	*16.8*	
ueue Storage Ratio												
ieue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
eue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
erage Queue Storage Ratio												
% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst		Intersection	Recker Rd at Boulevard Road
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Recker Road at Boulevard Road PM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	0	1	1	0	1	2	0	1	2	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	118	3	28	107	3	189	26	596	74	445	945	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	40	0	0	10
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	WB Only	03	04	NS Perm	Excl. Left	07	08
Timing	G = 25.2	G = 3.0	G =	G =	G = 35.0	G = 10.4	G =	G =
	Y = 4	Y = 0	Y =	Y =	Y = 4	Y = 0	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 81.6		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
Adjusted Flow Rate, v	128	33		116	208		28	685		484	1267	
Lane Group Capacity, c	332	507		569	639		412	1539		532	1508	
v/c Ratio, X	0.39	0.07		0.20	0.33		0.07	0.45		0.91	0.84	
Total Green Ratio, g/C	0.31	0.31		0.39	0.39		0.61	0.43		0.61	0.43	
Uniform Delay, d_1	22.1	19.9		17.0	17.2		22.3	16.4		24.7	20.8	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k	0.11	0.11		0.11	0.11		0.11	0.11		0.43	0.38	
Incremental Delay, d_2	0.7	0.1		0.2	0.3		0.1	0.2		19.7	4.4	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	22.9	19.9		17.2	17.5		22.4	16.7		44.4	25.2	
Lane Group LOS	C	B		B	B		C	B		D	C	
Approach Delay	22.3			17.4			16.9			30.5		
Approach LOS	C			B			B			C		
Intersection Delay	25.3			X_c = 0.71			Intersection LOS			C		

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Recker Road at Boulevard Road PM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
Initial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
Flow Rate/Lane Group	*128*	*33*		*116*	*208*		*28*	*685*		*484*	*1267*	
Outflow/Lane	*1076*	*1641*		*1440*	*1619*		*680*	*1884*		*878*	*1846*	
Capacity/Lane Group	*332*	*507*		*569*	*639*		*412*	*1539*		*532*	*1508*	
Flow Ratio	*0.1*	*0.0*		*0.1*	*0.1*		*0.0*	*0.2*		*0.6*	0.4	
Vc Ratio	*0.39*	*0.07*		*0.20*	*0.33*		*0.07*	*0.45*		*0.91*	*0.84*	
Factor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
Platoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
UF Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
	2.3	*0.5*		*1.6*	*3.3*		*0.3*	*5.7*		*5.2*	*13.5*	
	0.3	*0.4*		*0.5*	*0.5*		*0.4*	*0.6*		*0.4*	*0.6*	
	0.2	*0.0*		*0.1*	*0.2*		*0.0*	*0.5*		*3.0*	*2.6*	
Average	*2.5*	*0.6*		*1.7*	*3.5*		*0.3*	*6.2*		*8.2*	*16.0*	

Percentile Back of Queue (95th percentile)

	2.0	2.1		2.0	2.0		2.1	1.9		1.9	1.7	
Back of Queue	*5.0*	*1.2*		*3.6*	*7.0*		*0.6*	*11.9*		*15.3*	*28.0*	

Queue Storage Ratio

Queue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
Queue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
Average Queue Storage Ratio												
95% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	MG	Intersection	Recker Rd at Pecos Road
Agency or Co.	TASK Eng	Area Type	All other areas
Date Performed	8/8/2006	Jurisdiction	Gilbert
Time Period		Analysis Year	
		Project ID	Recker Road at Pecos Road AM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	3	0	1	3	0	1	2	0	1	2	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	44	1228	190	149	741	30	264	593	219	39	343	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	40	0	0	10
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	Excl. Left	03	04	NS Perm	Excl. Left	07	08
Timing	G = 25.2	G = 3.0	G =	G =	G = 15.0	G = 5.4	G =	G =
	Y = 4	Y = 0	Y =	Y =	Y = 4	Y = 0	Y =	Y =

Duration of Analysis, T = 0.25 — Cycle Length, C = 56.6

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
Adjusted Flow Rate, v	48	1542		162	838		287	840		42	518	
Lane Group Capacity, c	426	2258		357	2291		434	925		434	919	
v/c Ratio, X	0.11	0.68		0.45	0.37		0.66	0.91		0.10	0.56	
Total Green Ratio, g/C	0.57	0.45		0.57	0.45		0.43	0.27		0.43	0.27	
Uniform Delay, d_1	9.1	12.5		17.3	10.4		18.6	20.1		16.7	18.0	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k	0.11	0.25		0.11	0.11		0.24	0.43		0.11	0.16	
Incremental Delay, d_2	0.1	0.9		0.9	0.1		3.7	12.6		0.1	0.8	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	9.3	13.4		18.2	10.5		22.3	32.8		16.8	18.8	
Lane Group LOS	A	B		B	B		C	C		B	B	
Approach Delay	13.3			11.7			30.1			18.6		
Approach LOS	B			B			C			B		
Intersection Delay	18.0			X_c = 0.81			Intersection LOS			B		

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Recker Road at Pecos Road AM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group	L	TR		L	TR		L	TR		L	TR	
Initial Queue/Lane	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Flow Rate/Lane Group	48	1542		162	838		287	840		42	518	
Satflow/Lane	750	1861		629	1888		1007	1834		1007	1820	
Capacity/Lane Group	426	2258		357	2291		434	925		434	919	
Flow Ratio	0.1	0.3		0.3	0.2		0.3	0.2		0.0	0.1	
v/c Ratio	0.11	0.68		0.45	0.37		0.66	0.91		0.10	0.56	
Factor	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Arrival Type	3	3		3	3		3	3		3	3	
Platoon Ratio	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
PF Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
N_1	0.3	7.1		1.2	3.2		2.9	6.7		0.4	3.7	
N_{ua}	0.3	0.5		0.3	0.5		0.3	0.3		0.3	0.3	
N_2	0.0	1.0		0.2	0.3		0.6	2.4		0.0	0.4	
Average	0.4	8.1		1.4	3.5		3.5	9.1		0.4	4.1	

Percentile Back of Queue (95th percentile)

%	2.1	1.9		2.1	2.0		2.0	1.9		2.1	2.0	
Back of Queue	0.8	15.2		2.9	6.9		6.9	16.9		0.9	8.2	

Queue Storage Ratio

Queue Spacing	25.0	25.0		25.0	25.0		25.0	25.0		25.0	25.0	
Queue Storage	0	0		0	0		0	0		0	0	
Average Queue Storage Ratio												
95% Queue Storage Ratio												

HCS+™ DETAILED REPORT

General Information

Analyst	MG
Agency or Co.	TASK Eng
Date Performed	8/8/2006
Time Period	

Site Information

Intersection	Recker Rd at Pecos Road
Area Type	All other areas
Jurisdiction	Gilbert
Analysis Year	
Project ID	Recker Road at Pecos Road PM Pk Hr-2025

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	3	0	1	3	0	1	2	0	1	2	
Lane Group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	115	896	232	238	1355	64	255	475	125	26	613	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l_1	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT	3	3		3	3		3	3		3	3	
Unit Extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	40	0	0	10
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0		0	0		0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	Excl. Left	03	04	NS Perm	Excl. Left	07	08
Timing	G = 25.2	G = 3.0	G =	G =	G = 15.0	G = 5.4	G =	G =
	Y = 4	Y = 0	Y =	Y =	Y = 4	Y = 0	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 56.6		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	
Adjusted Flow Rate, v	125	1226		259	1543		277	608		28	755	
Lane Group Capacity, c	357	2233		357	2288		434	937		434	942	
v/c Ratio, X	0.35	0.55		0.73	0.67		0.64	0.65		0.06	0.80	
Total Green Ratio, g/C	0.57	0.45		0.57	0.45		0.43	0.27		0.43	0.27	
Uniform Delay, d_1	16.2	11.5		18.5	12.4		19.6	18.5		15.3	19.4	
Progression Factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k	0.11	0.15		0.29	0.25		0.22	0.23		0.11	0.35	
Incremental Delay, d_2	0.6	0.3		7.2	0.8		3.1	1.6		0.1	5.0	
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	16.8	11.8		25.7	13.2		22.7	20.1		15.4	24.5	
Lane Group LOS	B	B		C	B		C	C		B	C	
Approach Delay	12.3			15.0			20.9			24.1		
Approach LOS	B			B			C			C		
Intersection Delay	16.8			X_c = 0.86			Intersection LOS			B		

11/8/2006

BACK-OF-QUEUE WORKSHEET

General Information

Project Description *Recker Road at Pecos Road PM Pk Hr-2025*

Average Back of Queue

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
Initial Queue/Lane	*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*		*0.0*	*0.0*	
Flow Rate/Lane Group	*125*	*1226*		*259*	*1543*		*277*	*608*		*28*	*755*	
Outflow/Lane	*629*	*1841*		*629*	*1886*		*1007*	*1856*		*1007*	*1866*	
Capacity/Lane Group	*357*	*2233*		*357*	*2288*		*434*	*937*		*434*	*942*	
Flow Ratio	*0.2*	*0.2*		*0.4*	*0.3*		*0.3*	*0.2*		*0.0*	*0.2*	
v/c Ratio	*0.35*	*0.55*		*0.73*	*0.67*		*0.64*	*0.65*		*0.06*	*0.80*	
Factor	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
Platoon Ratio	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
PF Factor	*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*		*1.00*	*1.00*	
N_1	*0.9*	*5.2*		*1.9*	*7.1*		*2.8*	*4.5*		*0.3*	*5.8*	
N_s	*0.3*	*0.5*		*0.3*	*0.5*		*0.3*	*0.3*		*0.3*	*0.3*	
N_2	*0.2*	*0.6*		*0.7*	*0.9*		*0.5*	*0.6*		*0.0*	*1.3*	
N Average	*1.0*	*5.8*		*2.6*	*8.0*		*3.3*	*5.1*		*0.3*	*7.1*	

Percentile Back of Queue (95th percentile)

N_{95}	*2.1*	*1.9*		*2.0*	*1.9*		*2.0*	*2.0*		*2.1*	*1.9*	
Back of Queue	*2.1*	*11.1*		*5.3*	*15.1*		*6.6*	*9.9*		*0.6*	*13.5*	

Queue Storage Ratio

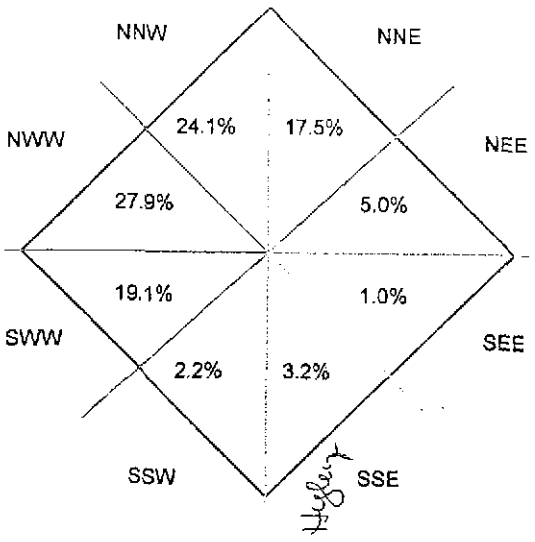
Queue Spacing	*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*		*25.0*	*25.0*	
Queue Storage	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
Average Queue Storage Ratio												
95% Queue Storage Ratio												

MAG Trip Distribution
Version 1.3.0

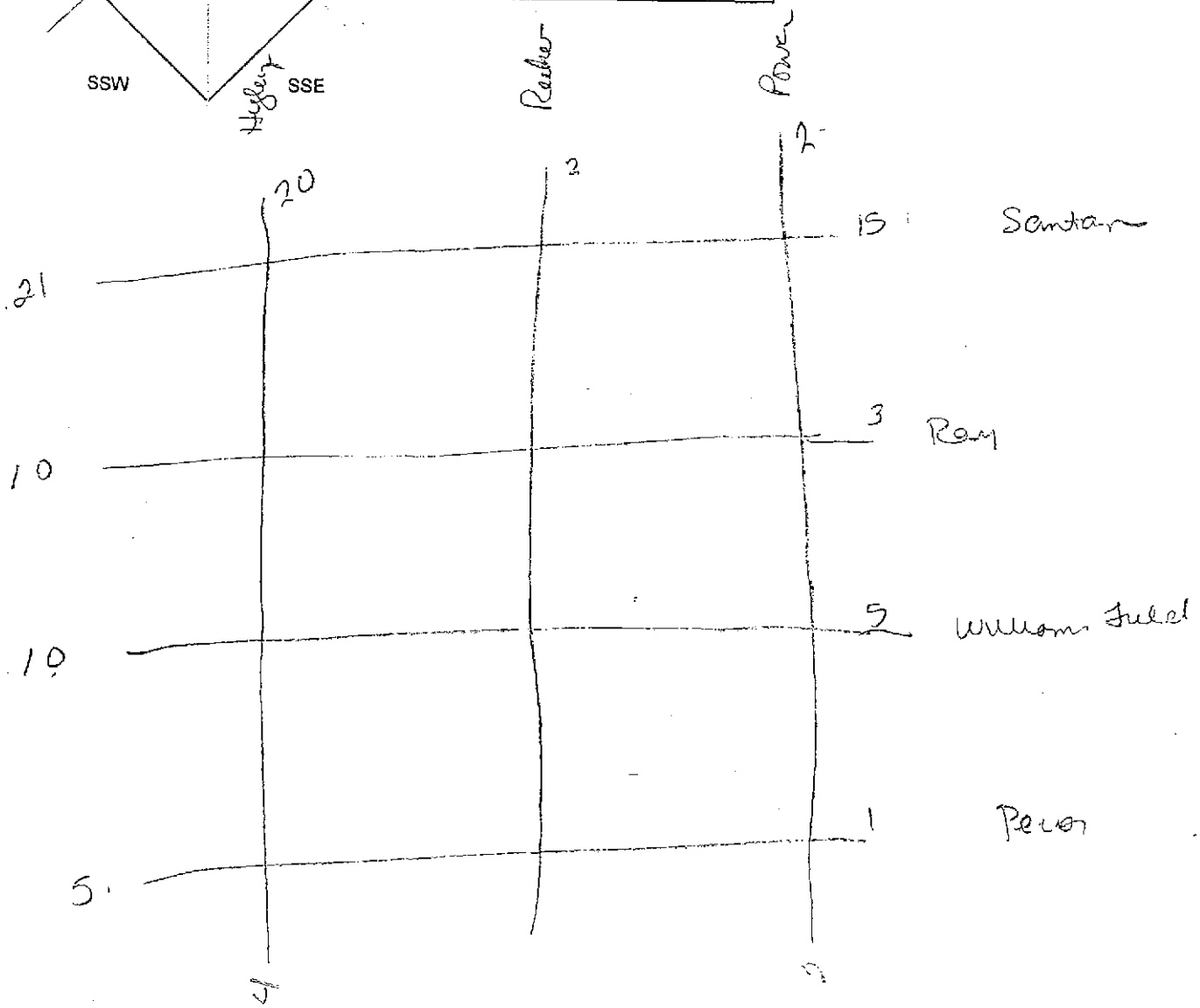
Wednesday, August 2, 2006
9:24 AM

Project Name: Cooley Station
Project Location: Gilbert, AZ
Analyst: SAD

Location of Site: TAZ 1562
Development Type being Analyzed: Residential and Employment 47.0% Weighted Employment
Forecast Year: 2020
Distance Out from Site (miles): 12



Bearing	% of Trips
NNE	17.5%
NEE	5.0%
SEE	1.0%
SSE	3.2%
SSW	2.2%
SWW	19.1%
NWW	27.9%
NNW	24.1%



APPENDIX C:

ADJACENT TRIP GENERATION

Adjacent Park

TAZ	Parcel #	TC ID	Parcel Type	Units	Acres	Amount	L.U.C.	Trip Rates					Total				
								Daily Rate	AM Rate	PM Rate	% In AM	% In PM	Weekday	AM In	AM Out	PM In	PM Out
1	1	295	Park	Acres	100	100	412	2.28	0.01	0.06	80%	41%	228	1	0	2	4
			Sum of DUs			100							228	1	0	2	4

Dibella

TAZ	Parcel #	TC ID	Parcel Type	Units	Acres	Amount	L.U.C.	Trip Rates					Total				
								Daily Rate	AM Rate	PM Rate	% In AM	% In PM	Weekday	AM In	AM Out	PM In	PM Out
1	Residential	300	Residential	DUs	56.5	1,413	220	6.72	0.51	0.62	20%	65%	9,492	144	576	569	307
2	Commercial	298	Commercial	TGSF	19.3	210.177	820	52.36	1.16	4.86	61%	48%	11,005	149	95	490	531
			Sum of DUs			0							**20,497**	**293**	**671**	**1,060**	**838**

Adjacent Existing High School

TAZ	Parcel #	TC ID	Parcel Type	Units	Acres	Amount	L.U.C.	Trip Rates					Total				
								Daily Rate	AM Rate	PM Rate	% In AM	% In PM	Weekday	AM In	AM Out	PM In	PM Out
1	1	302	High School	Students	NA	1200	530	1.71	0.41	0.28	69%	80%	2,052	339	153	269	67
													2,052	339	153	269	67

APPENDIX D:

ADJACENT PRODUCTIONS AND ATTRACTIONS

Adjacent Park

TAZ	Parcel #	TC ID	Parcel Type	Units	Acres	Amount	% Attractions	Trip Rates					Total				
								Weekday	AM In	AM Out	PM In	PM Out	Weekday	AM In	AM Out	PM In	PM Out
1	1	295	Park	Acres	100	100	100%	0	0	0	0	0	228	1	0	2	4
			Sum of DUs			100		**0**	**0**	**0**	**0**	**0**	**228**	**1**	**0**	**2**	**4**

Dibella

TAZ	Parcel #	TC ID	Parcel Type	Units	Acres	Amount	% Attractions	Trip Productions					Trip Attractions				
								Weekday	AM In	AM Out	PM In	PM Out	Weekday	AM In	AM Out	PM In	PM Out
1	Residential	300	Residential	DUs	56.5	1,413	5%	9,017	137	547	541	291	475	7	29	28	15
2	Commercial	298	Commercial	TGSF	19.3	210.177	50%	5,502	74	48	245	266	5,502	74	48	245	266
			Sum of DUs			0		**14,520**	**211**	**595**	**786**	**557**	**5,977**	**82**	**76**	**274**	**281**

Adjacent Existing High School

TAZ	Parcel #	TC ID	Parcel Type	Units	Acres	Amount	% Attractions	Trip Productions					Trip Attractions				
								Weekday	AM In	AM Out	PM In	PM Out	Weekday	AM In	AM Out	PM In	PM Out
1	1	302	High School	Students	NA	1200	85%	308	51	23	40	10	1,744	289	130	228	57
								308	**51**	**23**	**40**	**10**	**1,744**	**289**	**130**	**228**	**57**

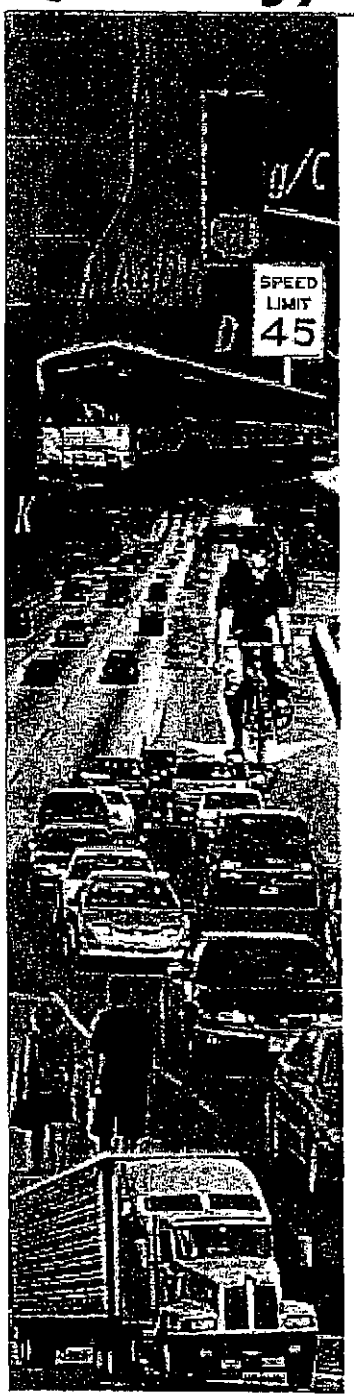
APPENDIX E:

FLORIDA DEPARTMENT OF TRANSPORTATION *QUALITY/LEVEL OF SERVICE HANDBOOK*

2002

Quality/Level of Service

HANDBOOK

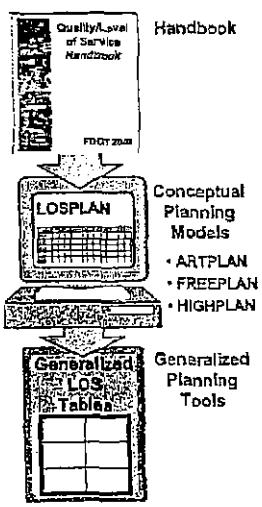


State of Florida
Department of Transportation
2002

EXECUTIVE SUMMARY

Handbook used for roadway planning and preliminary engineering analyses

This Handbook successfully combines the nation's leading automobile, bicycle, pedestrian, and bus evaluation techniques into a common analysis process.



This Quality/Level of Service Handbook and its accompanying software are intended to be used by engineers, planners, and decision-makers in the development and review of roadway users' quality/level of service (Q/LOS) at planning and preliminary engineering levels. This Handbook provides tools to quantify multimodal transportation service inside the roadway environment (essentially inside the right-of-way).

These updated methods provide the first successful multimodal approach unifying the nation's leading automobile, bicycle, pedestrian and bus Q/LOS evaluation techniques into a common transportation analysis at facility and segment levels. With these professionally accepted techniques, analysts can now easily evaluate roadways from a multimodal perspective, which result in better multimodal decisions for projects in planning and preliminary engineering phases.

Two levels of analysis are included in this Handbook: (1) "generalized" planning and (2) "conceptual" planning. Generalized planning makes extensive use of statewide default values and is intended for broad applications such as statewide analyses, initial problem identification, and future year analyses. Conceptual planning is increasingly more detailed and accurate than generalized planning, but does not involve comprehensive operational analyses.

Generalized planning is most appropriate when a quick, "in the ball park" determination of LOS is needed. Florida's Generalized Tables found in this Handbook are the primary tools for conducting this type of planning analysis. The default values used for the Generalized Tables have been extensively researched and represent the most appropriate statewide values.

Conceptual planning is best suited for obtaining a solid determination of the LOS of a facility. Examples of conceptual planning are preliminary engineering applications, such as determining the design concept and scope for a facility (e.g., 4 through lanes with a raised median and bicycle lane), conducting alternatives analyses (e.g., 4 through lanes undivided versus 2 through lanes with a two-way left turn lane), and determining needs when a generalized planning approach is simply not accurate enough. Florida's LOS software (LOSPLAN),

which includes ARTPLAN, FREEPLAN, and HIGHPLAN, is the easy to use tool for conducting these types of evaluations.

Implementation schedule

The techniques contained in this Handbook and the accompanying software are to be implemented immediately. After September 1, 2002, FDOT will not accept analyses using methods, techniques, volumes, or generalized tables from previous versions of this Handbook.

Handbook changes

Multimodal perspective includes bicycles, pedestrians, and buses as well as automobiles.

New freeway facility planning technique and updated software

Analytical methodologies for automobiles, bicycles, pedestrians, and buses.

The most significant difference in this Handbook from previous editions is the multimodal perspective. In addition to traditional "highway" (automobile and truck) LOS analysis, state-of-the-art techniques are now provided allowing a simultaneous evaluation of the LOS for bicyclists, pedestrians, and buses. Although LOS techniques are provided for each roadway mode, FDOT recommends against combining their LOS into one overall roadway LOS. Other significant changes include a new freeway facility planning technique and completely updated software.

The updated methodologies are planning and preliminary engineering applications from the following primary resource documents and analytical techniques using actual Florida roadway, traffic and signalization data:

- 2000 Highway Capacity Manual (HCM2000) methodologies for automobiles and trucks;
- 1999 Transit Capacity and Quality of Service Manual (TCQSM) for buses;
- Bicycle LOS Model, the most used technique in the U.S. to evaluate LOS for bicyclists; and
- Pedestrian LOS Model, the most advanced technique in the U.S. to evaluate LOS for pedestrians.

Florida's LOS standards

Also included are Florida's Statewide Minimum LOS Standards for the State Highway System. These standards are required for use on Florida Intrastate Highway System (FIHS) routes.

User feedback

Comments and suggestions are welcome.

In order to make future editions of this Handbook and accompanying software even better, FDOT welcomes your review comments and suggestions. Chapter 8 contains a user survey and a software "bug" report form.

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TABLE 4 - 1
GENERALIZED **ANNUAL AVERAGE DAILY** VOLUMES FOR FLORIDA'S **URBANIZED AREAS***

UNINTERRUPTED FLOW HIGHWAYS

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	2,000	7,000	13,800	19,600	27,000
4	Divided	20,400	33,000	47,800	61,800	70,200
6	Divided	30,500	49,500	71,600	92,700	105,400

STATE TWO-WAY ARTERIALS

Class I (>0.00 to 1.99 signalized intersections per mile)

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	4,200	13,800	16,400	16,900
4	Divided	4,800	29,300	34,700	35,700	***
6	Divided	7,300	44,700	52,100	53,500	***
8	Divided	9,400	58,000	66,100	67,800	***

Class II (2.00 to 4.50 signalized intersections per mile)

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	1,900	11,200	15,400	16,300
4	Divided	**	4,100	26,000	32,700	34,500
6	Divided	**	6,500	40,300	49,200	51,800
8	Divided	**	8,500	53,300	63,800	67,000

Class III (more than 4.5 signalized intersections per mile and not within primary city central business district of an urbanized area over 750,000)

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	**	5,300	12,600	15,500
4	Divided	**	**	12,400	28,900	32,800
6	Divided	**	**	19,500	44,700	49,300
8	Divided	**	**	25,800	58,700	63,800

Class IV (more than 4.5 signalized intersections per mile and within primary city central business district of an urbanized area over 750,000)

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	**	5,200	13,700	15,000
4	Divided	**	**	12,300	30,300	31,700
6	Divided	**	**	19,100	45,800	47,600
8	Divided	**	**	25,900	59,900	62,200

NON-STATE ROADWAYS

Major City/County Roadways

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	**	9,100	14,600	15,600
4	Divided	**	**	21,400	31,100	32,900
6	Divided	**	**	33,400	46,800	49,300

Other Signalized Roadways
(signalized intersection analysis)

Lanes	Divided	Level of Service A	B	C	D	B
2	Undivided	**	**	4,800	10,000	12,600
4	Divided	**	**	11,100	21,700	25,200

Source: Florida Department of Transportation 02/22/02
Systems Planning Office
605 Suwannee Street, MS 19
Tallahassee, FL 32399-0450
http://www11.myflorida.com/planning/systems/sm/los/default.htm

FREEWAYS

Interchange spacing ≥ 2 mi. apart

Lanes	Level of Service A	B	C	D	E
4	23,800	39,600	55,200	67,100	74,600
6	36,900	61,100	85,300	103,600	115,300
8	49,900	82,700	115,300	140,200	156,000
10	63,000	104,200	145,500	176,900	196,400
12	75,900	125,800	175,500	213,500	237,100

Interchange spacing < 2 mi. apart

Lanes	Level of Service A	B	C	D	E
4	22,000	36,000	52,000	67,200	76,500
6	34,800	56,500	81,700	105,800	120,200
8	47,500	77,000	111,400	144,300	163,900
10	60,200	97,500	141,200	182,600	207,600
12	72,900	118,100	170,900	221,100	251,200

BICYCLE MODE

(Note: Level of service for the bicycle mode in this table is based on roadway geometrics at 40 mph posted speed and traffic conditions, not number of bicyclists using the facility.) (Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Paved Shoulder/ Bicycle Lane Coverage	Level of Service A	B	C	D	E
0-49%	**	**	3,200	13,800	>13,800
50-84%	**	2,500	4,100	>4,100	***
85-100%	3,100	7,200	>7,200	***	***

PEDESTRIAN MODE

(Note: Level of service for the pedestrian mode in this table is based on roadway geometrics at 40 mph posted speed and traffic conditions, not number of pedestrians using the facility.) (Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Sidewalk Coverage	Level of Service A	B	C	D	E
0-49%	**	**	**	6,400	15,500
50-84%	**	**	**	9,900	19,000
85-100%	**	2,200	11,300	>11,300	***

BUS MODE (Scheduled Fixed Route)

(Buses per hour)

(Note: Buses per hour shown are only for the peak hour in the single direction of the higher traffic flow.)

Sidewalk Coverage	Level of Service A	B	C	D	E
0-84%	**	>5	≥4	≥3	≥2
85-100%	>6	>4	≥3	≥2	≥1

ARTERIAL/NON-STATE ROADWAY ADJUSTMENTS

DIVIDED/UNDIVIDED
(alter corresponding volume by the indicated percent)

Lanes	Median	Left Turns Lanes	Adjustment Factors
2	Divided	Yes	+5%
2	Undivided	No	-20%
Multi	Undivided	Yes	-5%
Multi	Undivided	No	-25%

ONE-WAY FACILITIES

Decrease corresponding two-directional volumes in this table by 40% to obtain the equivalent one directional volume for one-way facilities.

*This table does not constitute a standard and should be used only for general planning applications. The *computer models from which* this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Values shown are two-way annual average daily volumes (based on K_{100} factors) for levels of service and are for the automobile/truck modes unless specifically stated. Level of service letter grade thresholds are probably not comparable across modes and, therefore, cross modal comparisons should be made with caution. Furthermore, combining levels of service of different modes into one overall roadway level of service is not recommended. The table's input value defaults and level of service criteria appear on the following page. Calculations are based on planning applications of the Highway Capacity Manual, Bicycle LOS Model, Pedestrian LOS Model and Transit Capacity and Quality of Service Manual, respectively for the automobile/truck, bicycle, pedestrian and bus modes.

**Cannot be achieved using table input value defaults.

***Not applicable for that level of service letter grade. For automobile/truck modes, volumes greater than level of service D become F because intersection capacities have been reached. For bicycle and pedestrian modes, the level of service letter grade (including F) is not achievable, because there is no maximum vehicle volume threshold using table input value defaults.

TABLE 4 - 1 (continued)

GENERALIZED **ANNUAL AVERAGE DAILY** VOLUMES FOR FLORIDA'S

Urbanized Areas

INPUT VALUE ASSUMPTIONS

	UNINTERRUPTED FLOW FACILITIES			
	Freeways		Highways	
ROADWAY CHARACATERISTICS	Class III	Class IV		
Number of through lanes	4 - 12	4 - 12	2	4 - 6
Posted speed (mph)	65	55	50	50
Free flow speed (mph)	70	60	55	55
Basic segment length (mi)	1.5	0		
Interchange spacing per mile	2.5	1		
Median (n,y)			n	y
Left turn lanes (n,y)			y	y
Terrain (r,l)	l	l	l	l
% no passing zone			80	
Passing lanes (n,y)			n	
TRAFFIC CHARACTERISTICS				
Planning analysis hour factor (K)	0.097	0.093	0.095	0.095
Directional distribution factor (D)	0.55	0.55	0.55	0.55
Peak hour factor (PHF)	0.95	0.95	0.925	0.925
Base capacity (pcphpl)			1700	2100
Heavy vehicle percent	6.0	4.0	2.0	2.0
Local adjustment factor	0.98	1.00	1.0	1.0

	INTERRUPTED FLOW FACILITIES																	
	State Arterials												Non-State Roadways			Bicycle	Pedestrian	Bus
	Class I			Class II			Class III			Class IV			Major City/County		Other Signalized	Class II	Class II	
ROADWAY CHARACTERISTICS																		
Number of through lanes	2	4 - 6	8	2	4 - 6	8	2	4 - 6	8	2	4 - 6	8	2	4 - 6	2 - 4	4	4	
Posted speed (mph)	45	50	50	45	45	45	35	35	35	30	30	30	45	45		40	40	
Free flow speed (mph)	50	55	55	50	50	50	40	40	40	35	35	35	50	50		45	45	
Median type (n,m,r)	N	r	r	n	r	r	n	r	r	n	r	r	n	r		r	r	
Left turn lanes (n,y)	Y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	
Paved shoulder/bicycle lane (n,y)																n,50%,y	n	
Outside lane width (n,t,w)																t	t	
Pavement condition (u,t,d)																t		
Sidewalk (n,y)																	n,50%,y	n,y
Sidewalk/roadway separation (n,t,w)																	t	
Sidewalk/roadway protective barrier (n,y)																	n	
Obstacle to bus stop (n,y)																		n
TRAFFIC CHARACTERISTICS																		
Planning analysis hour factor (K)	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	
Directional distribution factor (D)	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	
Peak hour factor (PHF)	0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925	0.925	
Base saturation flow rate (pcphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Heavy vehicle percent	2.0	2.0	2.0	2.0	2.0	2.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	2.0	2.0	
Local adjustment factor	1.0	1.0	0.95	0.98	0.98	0.95	0.95	0.95	0.92	0.92	0.92	0.90	0.98	0.98	0.95	0.98	0.98	
% turns from exclusive turn lanes	12	12	12	12	12	12	12	12	12	12	12	12	14	14	16	12	12	
Bus span of service																		15
CONTROL CHARACTERISTICS																		
Signalized intersections per mile	1.5	1.0	1.0	3.0	3.0	3.0	5.0	5.0	5.0	8.0	8.0	8.0	3.0	3.0		3.0	3.0	
Arrival type (1-6)	3	3	3	4	4	4	4	4	4	4	4	4	4	4	3	4	4	
Signal type (a,s,f)	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	
Cycle length (C)	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	
Effective green ratio (g/C)	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.41	0.41	0.31	0.44	0.44	

LEVEL OF SERVICE THRESHOLDS

	Freeways				Highways			State Two-Way Arterials				Non-State Roadways		Bicycle	Pedestrian	Bus
Level of Service	Class III		Class IV		Two-Lane	Multilane		Class I	Class II	Class III	Class IV	Major City/County	Other Signalized			
	v/c	Density	v/c	Density	% FFS	v/c	Density	ATS	ATS	ATS	ATS	ATS	Control Delay	Score	Score	Buses per hr.
A	≤ 0.32	≤ 11	≤ 0.29	≤ 11	> 0.917	≤ 0.29	≤ 11	> 42 mph	> 35 mph	> 30 mph	> 25 mph	> 35 mph	≤ 10 sec	≤ 1.5	≤ 1.5	> 6
B	≤ 0.53	≤ 18	≤ 0.47	≤ 18	> 0.833	≤ 0.47	≤ 18	> 34 mph	> 28 mph	> 24 mph	> 19 mph	> 28 mph	≤ 20 sec	≤ 2.5	≤ 2.5	> 4
C	≤ 0.74	≤ 26	≤ 0.68	≤ 26	> 0.750	≤ 0.68	≤ 26	> 27 mph	> 22 mph	> 18 mph	> 13 mph	> 22 mph	≤ 35 sec	≤ 3.5	≤ 3.5	≥ 3
D	≤ 0.90	≤ 35	≤ 0.88	≤ 35	> 0.667	≤ 0.88	≤ 35	> 21 mph	> 17 mph	> 14 mph	> 9 mph	> 17 mph	≤ 55 sec	≤ 4.5	≤ 4.5	≥ 2
E	≤ 1.00	≤ 45	≤ 1.00	≤ 45	> 0.583	≤ 1.00	≤ 41	> 16 mph	> 13 mph	> 10 mph	> 7 mph	> 13 mph	≤ 80 sec	≤ 5.5	≤ 5.5	≥ 1
F	> 1.00	> 45	> 1.00	> 45	≤ 0.583	> 1.00	> 41	≤ 16 mph	≤ 13 mph	≤ 10 mph	≤ 7 mph	≤ 13 mph	> 80 sec	> 5.5	> 5.5	< 1

v/c = Demand to Capacity Ratio % FFS = Percent Free Flow Speed ATS = Average Travel Speed

02/22/02

TABLE 4 - 2
GENERALIZED **ANNUAL AVERAGE DAILY** VOLUMES FOR FLORIDA'S **AREAS TRANSITIONING INTO URBANIZED AREAS** OR **AREAS OVER 5,000 NOT IN URBANIZED AREAS***

UNINTERRUPTED FLOW HIGHWAYS

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	2,100	6,900	12,900	18,200	24,900
4	Divided	18,600	30,200	43,600	56,500	64,200
6	Divided	27,900	45,200	65,500	84,700	96,200

STATE TWO-WAY ARTERIALS

Class I (>0.00 to 1.99 signalized intersections per mile)

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	4,000	13,100	15,500	16,300
4	Divided	4,600	27,900	32,800	34,200	***
6	Divided	6,900	42,800	49,300	51,400	***

Class II (2.00 to 4.50 signalized intersections per mile)

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	**	10,500	14,500	15,300
4	Divided	**	3,700	24,400	30,600	32,200
6	Divided	**	6,000	38,000	46,100	48,400

Class III (more than 4.5 signalized intersections per mile)

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	**	5,000	11,800	14,600
4	Divided	**	**	11,700	27,200	30,800
6	Divided	**	**	18,400	42,100	46,300

NON-STATE ROADWAYS

Major City/County Roadways

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	**	7,000	13,600	14,600
4	Divided	**	**	16,400	29,300	30,900
6	Divided	**	**	25,700	44,100	46,400

Other Signalized Roadways
(signalized intersection analysis)

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	**	4,400	9,400	12,000
4	Divided	**	**	10,300	20,200	24,000

Source: Florida Department of Transportation 02/22/02
Systems Planning Office
605 Suwannee Street, MS 19
Tallahassee, FL 32399-0450
http://www11.myflorida.com/planning/systems/sm/los/default.htm

FREEWAYS

Lanes	Level of Service A	B	C	D	E
4	23,500	38,700	52,500	62,200	69,100
6	36,400	59,800	81,100	96,000	106,700
8	49,100	80,900	109,600	129,800	144,400
10	61,800	101,800	138,400	163,800	182,000

BICYCLE MODE

(Note: Level of service for the bicycle mode in this table is based on roadway geometrics at 40 mph posted speed and traffic conditions, not number of bicyclists using the facility.) (Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Paved Shoulder/ Bicycle Lane Coverage	Level of Service A	B	C	D	E
0-49%	**	1,900	3,300	13,600	>13,600
50-84%	**	2,500	4,000	>4,000	***
85-100%	3,200	7,100	>7,100	***	***

PEDESTRIAN MODE

(Note: Level of service for the pedestrian mode in this table is based on roadway geometric at 40 mph posted speed and traffic conditions, not number of pedestrians using the facility.) (Multiply motorized vehicle volumes shown by number of directional roadway lanes to determine two-way maximum service volumes.)

% Sidewalk Coverage	Level of Service A	B	C	D	E
0-49%	**	**	**	6,300	15,400
50-84%	**	**	**	9,800	18,800
85-100%	**	2,200	11,200	>11,200	***

ARTERIAL/NON-STATE ROADWAY ADJUSTMENTS

DIVIDED/UNDIVIDED

Lanes	Median	Left Turn Lanes	Adjustment Factors
2	Divided	Yes	+5%
2	Undivided	No	-20%
Multi	Undivided	Yes	-5%
Multi	Undivided	No	-25%

ONE-WAY FACILITIES

Decrease corresponding two-directional volumes in this table by 40% to obtain the equivalent one directional volume for one-way facilities.

*This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Values shown are two-way annual average daily volumes (based on K_{100} factors) for levels of service and are for the automobile/truck modes unless specifically stated. Level of service letter grade thresholds are probably not comparable across modes and, therefore, cross modal comparisons should be made with caution. Furthermore, combining levels of service of different modes into one overall roadway level of service is not recommended. The table's input value defaults and level of service criteria appear on the following page. Calculations are based on planning applications of the Highway Capacity Manual, Bicycle LOS Model, and Pedestrian LOS Model, respectively for the automobile/truck, bicycle and pedestrian modes.

**Cannot be achieved using table input value defaults.

***Not applicable for the level of service letter grade. For automobile/truck modes, volumes greater than level of service D become F because intersection capacities have been reached. For bicycle and pedestrian modes, the level of service letter grade (including F) is not achievable, because there is no maximum vehicle volume threshold using table input value defaults.

TABLE 4 - 2 (continued)

GENERALIZED **ANNUAL AVERAGE DAILY** VOLUMES FOR FLORIDA'S **AREAS TRANSITIONING INTO URBANIZED AREAS** OR **AREAS OVER 5,000 NOT IN URBANIZED AREAS**

INPUT VALUE ASSUMPTIONS

	UNINTERRUPTED FLOW FACILITIES		
	Freeways	Highways	
ROADWAY CHARACATERISTICS	Class II		
Number of through lanes	4 - 10	2	4 - 6
Posted speed (mph)	70	50	50
Free flow speed (mph)	75	55	55
Basic segment length (mi)	3		
Interchange spacing per mile	4		
Median (n,y)		n	y
Left turn lanes (n,y)		y	y
Terrain (r,l)	l	l	l
% no passing		60	
Passing lanes (n,y)		n	
TRAFFIC CHARACTERISTICS			
Planning analysis hour factor (K)	0.100	0.096	0.096
Directional distribution factor (D)	0.55	0.55	0.55
Peak hour factor (PHF)	0.95	0.910	0.910
Base capacity (pcphpl)		1700	2100
Heavy vehicle percent	9.0	4.0	4.0
Local adjustment factor	0.95	0.95	0.95

	INTERRUPTED FLOW FACILITIES										
	State Arterials						Non-State Roadways			Bicycle	Pedestrian
ROADWAY CHARACTERISTICS	Class I		Class II		Class III		Major City/County		Other Signalized	Class II	Class II
Number of through lanes	2	4 - 6	2	4 - 6	2	4 - 6	2	4 - 6	2 - 4	4	4
Posted speed (mph)	45	50	45	45	35	35	40	40		40	40
Free flow speed (mph)	50	55	50	50	40	40	45	45		45	45
Median type (n,or,r)	n	r	n	r	n	r	n	r		r	r
Left turn lanes (n,y)	y	y	y	y	y	y	y	y	y	y	y
Paved shoulder/bicycle lane (n,y)										n,50%,y	n
Outside lane width (n,t,w)										t	t
Pavement condition (u,t,d)										t	
Sidewalk (n,y)											n,50%,y
Sidewalk/roadway separation (n,t,w)											t
Sidewalk/roadway protective barrier (n,y)											n
TRAFFIC CHARACTERISTICS											
Planning analysis hour factor (K)	0.096	0.096	0.096	0.096	0.096	0.096	0.096	0.096	0.096	0.096	0.096
Directional distribution factor (D)	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Peak hour factor (PHF)	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910	0.910
Base saturation flow rate (pcphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Heavy vehicle percent	3.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Local adjustment factor	0.98	0.98	0.95	0.95	0.92	0.92	0.95	0.95	0.92	0.95	0.95
% turns from exclusive turn lanes	12	12	12	12	12	12	14	14	16	12	12
CONTROL CHARACTERISTICS											
Signalized intersections per mile	1.5	1.0	3.0	3.0	5.0	5.0	3.0	3.0		3.0	3.0
Arrival type (1-6)	3	3	4	4	4	4	4	4	3	4	4
Signal type (a,s,f)	a	a	s	s	s	s	s	s	a	a	a
Cycle length (C)	120	120	120	120	120	120	120	120	120	120	120
Effective green ratio (g/C)	0.44	0.44	0.44	0.44	0.44	0.44	0.41	0.41	0.31	0.44	0.44

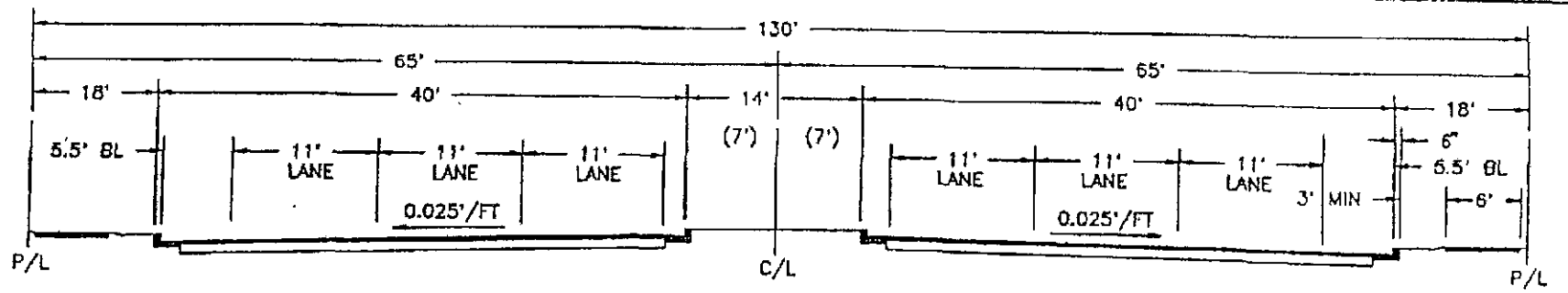
LEVEL OF SERVICE THRESHOLDS

	Freeways		Highways			State Two-Way Arterials			Non-State Roadways		Bicycle	Pedestrian
Level of Service	Class II v/c	Class II Density	Two-Lane % FFS	Multilane v/c	Multilane Density	Class I ATS	Class II ATS	Class III ATS	Major City/County ATS	Other Signalized Control Delay	Score	Score
A	≤ 0.34	≤ 11	> 0.917	≤ 0.29	≤ 11	> 42 mph	> 35 mph	> 30 mph	> 35 mph	≤ 10 sec	≤ 1.5	≤ 1.5
B	≤ 0.56	≤ 18	> 0.833	≤ 0.47	≤ 18	> 34 mph	> 28 mph	> 24 mph	> 28 mph	≤ 20 sec	≤ 2.5	≤ 2.5
C	≤ 0.76	≤ 26	> 0.750	≤ 0.68	≤ 26	> 27 mph	> 22 mph	> 18 mph	> 22 mph	≤ 35 sec	≤ 3.5	≤ 3.5
D	≤ 0.90	≤ 35	> 0.667	≤ 0.88	≤ 35	> 21 mph	> 17 mph	> 14 mph	> 17 mph	≤ 55 sec	≤ 4.5	≤ 4.5
E	≤ 1.00	≤ 45	> 0.583	≤ 1.00	≤ 41	> 16 mph	> 13 mph	> 10 mph	> 13 mph	≤ 80 sec	≤ 5.5	≤ 5.5
F	> 1.00	> 45	≤ 0.583	> 1.00	> 41	≤ 16 mph	≤ 13 mph	≤ 10 mph	≤ 13 mph	> 80 sec	> 5.5	> 5.5

v/c = Demand to Capacity Ratio % FFS = Percent Free Flow Speed ATS = Average Travel Speed

APPENDIX F:

TOWN OF GILBERT STANDARD CROSS SECTIONS

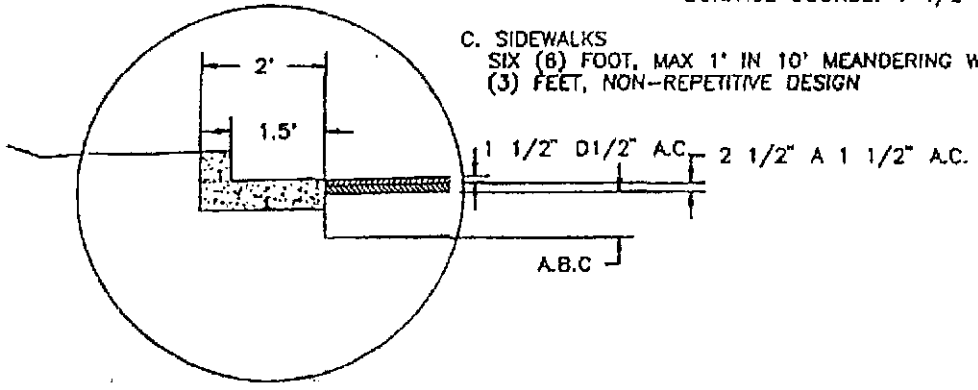


6 MOVING LANES

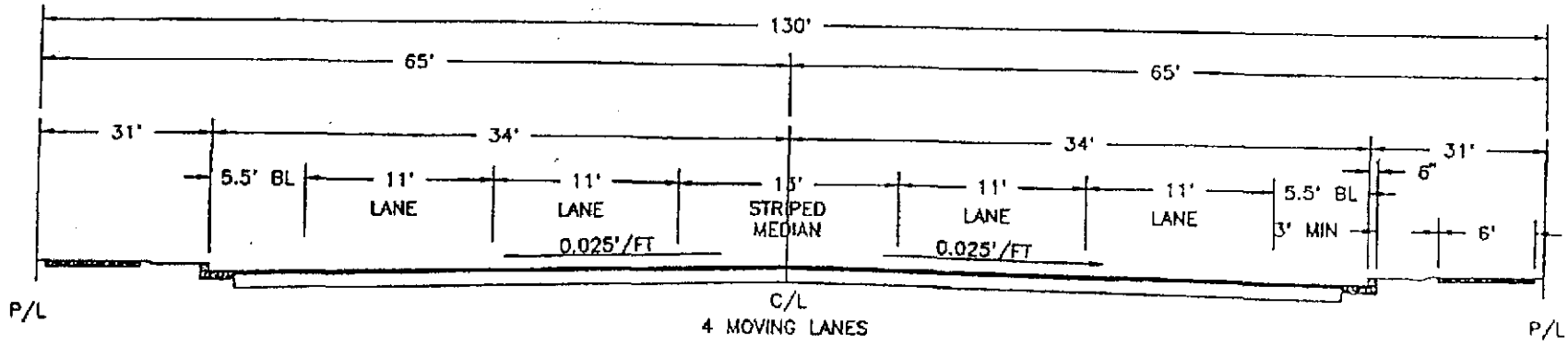
A. CONCRETE
1. CURB: M.A.G. STANDARD DETAIL 220 TYPE A. ALL CONCRETE M.A.G. STD.SPEC. CLASS "B"
2. SIDEWALK: M.A.G. STANDARD DETAIL 230 ALL CONCRETE M.A.G. STD. SPEC. CLASS "B"

B. PAVING
1. AGGREGATE BASE COURSE:
A. THICKNESS: TOWN OF GILBERT STANDARD DETAIL 33
B. MATERIAL: CONFORMING TO SECTION 702.2 M.A.G. STANDARD SPECIFICATIONS
2. ASPHALTIC CONCRETE:
A. THICKNESS FOUR (4") INCH MINIMUM PLACED IN TWO LIFTS
B. MATERIAL: CONFORMING TO M.A.G. STANDARD SPECIFICATIONS 710 (WITHOUT LIME)
BASE COURSE: 2 1/2"-A 1 1/2" MIX/5.0% OIL
SURFACE COURSE: 1 1/2"-D 1/2" MIX/6.0% OIL

C. SIDEWALKS
SIX (6) FOOT, MAX 1" IN 10' MEANDERING WALKWAY, DETACHED FROM C&G NO LESS THAN THREE (3) FEET, NON-REPETITIVE DESIGN



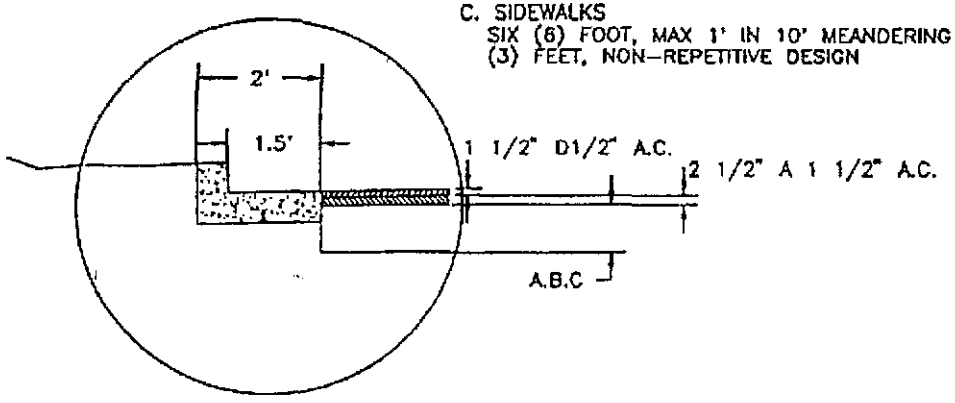
DETAIL NO. 21	TOWN OF GILBERT STANDARD DETAIL	MAJOR ARTERIAL STREET	REVISED 8/1/95	DETAIL NO. 21



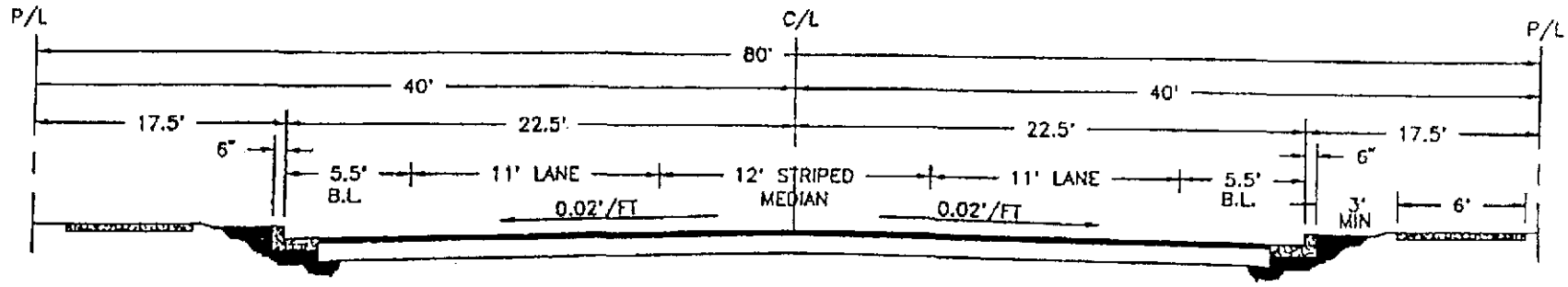
A. CONCRETE
1. CURB: M.A.G. STANDARD DETAIL 220 TYPE A. ALL CONCRETE M.A.G. STD.SPEC. CLASS "B"
2. SIDEWALK: M.A.G. STANDARD DETAIL 230 ALL CONCRETE M.A.G. STD. SPEC. CLASS "B"

B. PAVING
1. AGGREGATE BASE COURSE:
A. THICKNESS: TOWN OF GILBERT STANDARD DETAIL 33
B. MATERIAL: CONFORMING TO SECTION 702.2 M.A.G. STANDARD SPECIFICATIONS
2. ASPHALTIC CONCRETE:
A. THICKNESS FOUR (4") INCH MINIMUM PLACED IN TWO LIFTS
B. MATERIAL: CONFORMING TO M.A.G. STANDARD SPECIFICATIONS 710 (WITHOUT LIME)
BASE COURSE: 2 1/2"-A 1 1/2" MIX/5.0% OIL
SURFACE COURSE: 1 1/2"-D 1/2"MIX/6.0% OIL

C. SIDEWALKS
SIX (6) FOOT, MAX 1' IN 10' MEANDERING WALKWAY, DETACHED FROM C&G NO LESS THAN THREE (3) FEET, NON-REPETITIVE DESIGN



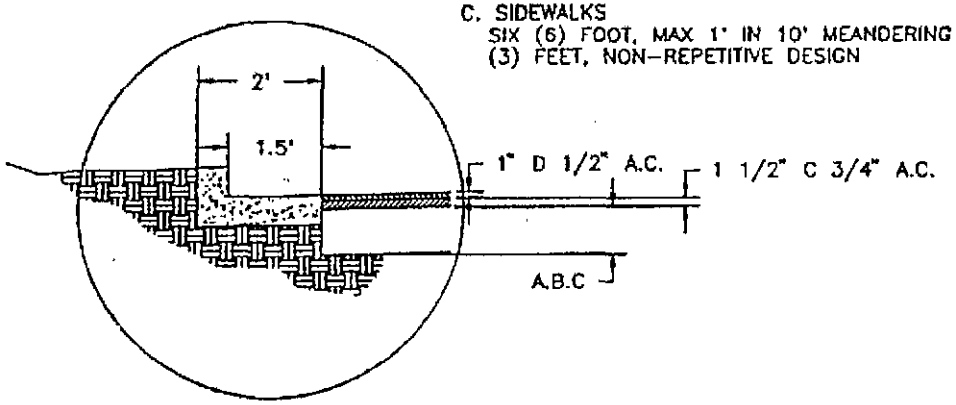
DETAIL NO. 22	TOWN OF GILBERT STANDARD DETAIL	MINOR ARTERIAL STREET	REVISED 8/1/95	DETAIL NO. 22



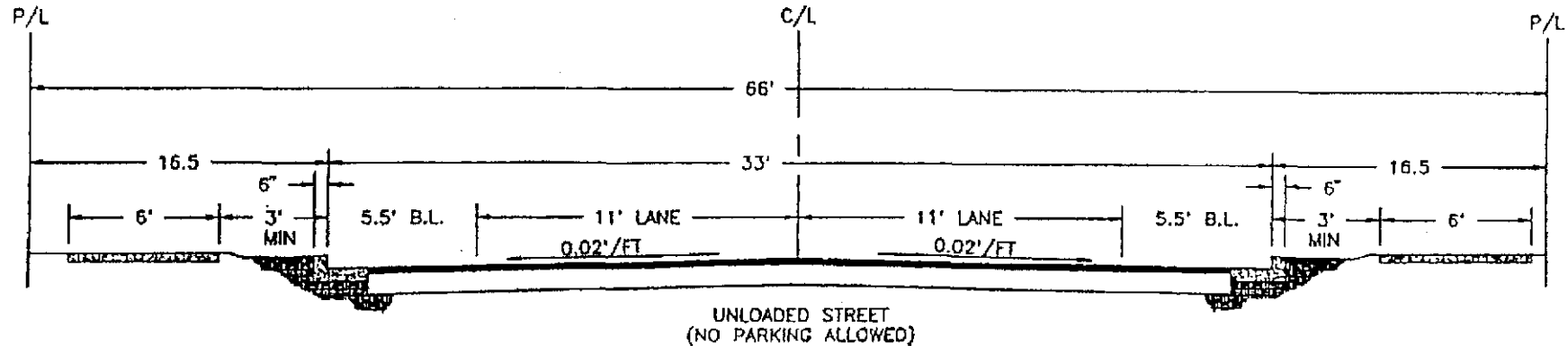
A. CONCRETE
1. CURB: M.A.G. STANDARD DETAIL 220 TYPE A. ALL CONCRETE M.A.G. STD.SPEC. CLASS "B"
2. SIDEWALK: M.A.G. STANDARD DETAIL 230 ALL CONCRETE M.A.G. STD. SPEC. CLASS "B"

B. PAVING
1. AGGREGATE BASE COURSE:
A. THICKNESS: TOWN OF GILBERT STANDARD DETAIL 34
B. MATERIAL: CONFORMING TO SECTION 702.2 M.A.G. STANDARD SPECIFICATIONS
2. ASPHALTIC CONCRETE:
A. THICKNESS TWO AND A HALF (2 1/2") INCH MINIMUM PLACED IN TWO LIFTS
B. MATERIAL: CONFORMING TO M.A.G. STANDARD SPECIFICATIONS 710 (WITHOUT LIME)
BASE COURSE: 1 1/2"-C 3/4" MIX/5.5% OIL
SURFACE COURSE: 1"-D 1/2"MIX/6.0% OIL

C. SIDEWALKS
SIX (6) FOOT, MAX 1' IN 10' MEANDERING WALKWAY, DETACHED FROM C&G NO LESS THAN THREE (3) FEET, NON-REPETITIVE DESIGN



DETAIL NO. 23	TOWN OF GILBERT STANDARD DETAIL	MAJOR COLLECTOR STREET	REVISED 8/1/95	DETAIL NO. 23

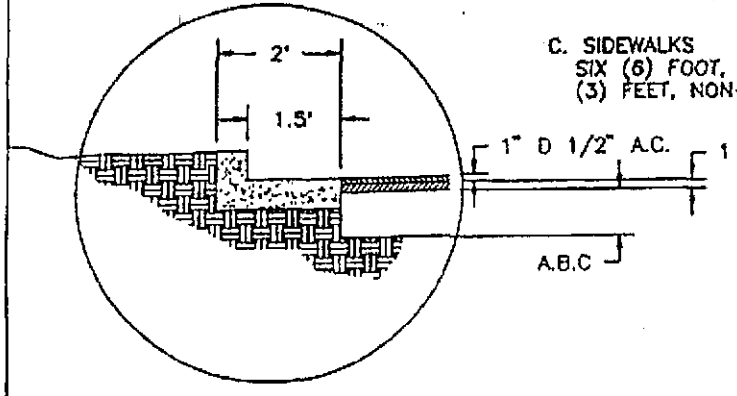


UNLOADED STREET
(NO PARKING ALLOWED)

A. CONCRETE
1. CURB: M.A.G. STANDARD DETAIL 220 TYPE A. ALL CONCRETE M.A.G. STD.SPEC. CLASS "B"
2. SIDEWALK: M.A.G. STANDARD DETAIL 230 ALL CONCRETE M.A.G. STD. SPEC. CLASS "B"

B. PAVING
1. AGGREGATE BASE COURSE:
A. THICKNESS: TOWN OF GILBERT STANDARD DETAIL 24
B. MATERIAL: CONFORMING TO SECTION 702.2 M.A.G. STANDARD SPECIFICATIONS
2. ASPHALTIC CONCRETE:
A. THICKNESS TWO AND A HALF (2 1/2") INCH MINIMUM PLACED IN TWO LIFTS
B. MATERIAL: CONFORMING TO M.A.G. STANDARD SPECIFICATIONS 710 (WITHOUT LIME)
BASE COURSE: 1 1/2"-C 3/4" MIX/5.5% OIL
SURFACE COURSE: 1"-D 1/2"MIX/6.0% OIL

C. SIDEWALKS
SIX (6) FOOT, MAX 1' IN 10' MEANDERING WALKWAY, DETACHED FROM C&G NO LESS THAN THREE (3) FEET, NON-REPETITIVE DESIGN



DETAIL NO. 24	TOWN OF GILBERT STANDARD DETAIL	RESIDENTAL COLLECTOR STREET	REVISED 8/1/95	DETAIL NO. 24

APPENDIX G:

TOWN OF GILBERT COMMENTS AND RESPONSE MEMORANDUM

TASK ENGINEERING
3707 North 7th Street • Suite 235 • Phoenix • AZ • 85014
Phone: 602 • 277 • 4224 Fax: 602 • 277 • 4228 e-mail: task@taskeng.net

November 7, 2006

MEMORANDUM

TO: Rick A, Town of Gilbert

FROM: Ken Howell, P.E.

RE: Response to Comments on Cooley Station Village Center & Business Park

The following summarizes responses to each comment made by the Town of Gilbert dated September 15, 2006, concerning the Cooley Station Traffic Impact Study, dated August 16, 2006. These responses have been incorporated into this final revised traffic impact study. Each comment is listed verbatim followed by a summary of how the comment is addressed or is incorporated into the final report.

1. *Report should indicate that trip generation, trip distribution and level of service are to be performed in accordance with the Institute of Transportation Engineers Trip Generation Manual 7th Edition and the Maricopa Association of Governments publications. The traffic stop sign and signal warrant analysis are to be performed in accordance with the Arizona Department of Transportation policies and the Manual on Traffic Control Devices.*

   The source for trip rates in this study were *Trip Generation, Seventh Edition,* 2003, and the *Trip Generation Handbook, 2nd Edition, June 2004,* published by the Institute of Transportation Engineers (ITE). The site trips were distributed proportionally to the sum of Year 2020 population and employment forecasts within ten miles of the center of the site. The projections used for the trip distribution were obtained from Year 2020 Population and Employment projections by the Maricopa Association of Government (MAG).

   For Year 2025, critical intersections were analyzed using the methodologies presented in the *Highway Capacity Manual, 2000 Edition* and were evaluated using the *HCS+* software. This is a standard software package used analyze both signalized and STOP sign controlled intersections. According to the information provided by McTrans, the developers of HCS+,

   > "The Highway Capacity Software (HCS) is developed and maintained by McTrans as part of its user-supported software maintenance as a faithful implementation of the Highway Capacity Manual (HCM) procedures... The Highway Capacity Manual (© 2000 National Academy of Sciences) is the basis for all capacity and level of service computations included in HCS.... The Manual on Uniform Traffic

Control Devices (MUTCD) is the basis for all signal warrant computations included in HCS."

For Year 2015, generalized average daily traffic (ADT) analysis was completed to determine the estimated number of lanes and level of service. These daily service volumes were taken from Table 4-2 of *Quality/Level of Service Handbook*, prepared by State of Florida Department of Transportation, 2002. The Transportation Impact Analysis for Site Development, An ITE Proposed Recommended Practice, refers to the Florida Department of Transportation method as an example of a planning level analysis for determining level of service.

The Maricopa Department of Transportation (MCDOT) procedures for determining if traffic signals are warranted on the basis of estimates of average daily traffic (ADT) were used. These procedures convert the major eight hour volume warrant of the *Manual on Uniform Traffic Control Devices* (MUTCD) into estimates of daily traffic, as appropriate for comparison with the daily traffic forecasts prepared for this report. The procedures and recommendations are discussed in the SIGNAL WARRANTS section that has been added to the revised report.

All procedures used in this report are standard, state of the practice procedures for the completion of traffic impact studies.

2. *Page 3, 2nd line, the phrase "located south of Recker" should state "located south of Ray Road".*

This has been changed in the revised report.

3. *Page 16, figures 5-1 and 5-2, turning movement counts are missing from turning movement diagrams A,B,C,D,H,I,N and S. In addition figures 5-1 and 5-2 do not identify the year for the Peak Hour Study Area traffic.*

The study area traffic identified on Figures 5-1 and 5-2 are for full buildout of the site. This is used for both the Year 2015 and Year 2025 total traffic volumes, as this represent the ultimate amount of traffic generated by the development. Based on this, a year is not indicated on the Study Area Traffic graphic.

The turning movements on Figures 5-1 and 5-2 are for traffic traveling to and from the developments located in the study area. Traffic traveling through the study area that are not traveling to a site within the study area are not included in these turning movements, but are reflected in background traffic volumes. Therefore, some turns may be zero at some intersections in Figures 5-1 and 5-2. This issue is discussed further in response to Comment 4 below.

4. *Page 25, figure 11-1, turning movement counts are missing from turning movement diagrams B,C,D,H and I.*

De minimus turns were added to the total traffic in locations where low (or no) turning movements were projected. The intersections in diagrams B, C, D, H, and I on Figure 11-1 have been adjusted to add these de minimus turns. This represents minor turning movements, of 5 per hour, or 2 per hour for low volume intersections.

5. *Page 31, under Traffic Signals, Williams Field Road and access 1 and Williams Field and access 2 are identified as being recommended for traffic signals, however, they are not identified on page 27, figure 12 where all other signal recommendations are identified.*

   Traffic signals are recommended at Williams Field Road/Access 1 and Williams Field Road/Access 2 for Year 2025. Year 2025 recommendations are shown on Figure 13-1 and 13-2. Year 2015 recommendations are shown on Figure 12.

   The SIGNAL WARRANT and RECOMMENDATION sections have been revised to clarify the recommendation year for the signals.

6. *Page 31, although this page identifies where right-turn deceleration lanes should be provided it does not address where dual left-turn lanes may need to be provided.*

   Dual left turn lanes have not been recommended for any intersections analyzed in this report. The graphics have been updated to reflect this.

7. *Page 32, under the heading Year 2015 conditions, the last bullet states that warranted traffic signals for 2015 are shown on figure 8, however, it is shown on figure 12.*

   This has been changed in the revised report.

8. *Page 32, under Year 2025 conditions the last bullet states that Power Road and Ray Road are recommended for 6 lanes for the year 2025. The study should indicate that this is per the Towns standard since the study data may not support the 6 lanes.*

   This has been added to the above referenced recommendation in the revised report.

9. *Page 33, under traffic signals recommended locations, please see comments in 5 above.*

   The SIGNAL WARRANT and RECOMMENDATION sections have been revised to clarify the recommendation year for signals.

I hope this addresses the remaining issues regarding this report. If there are any further comments, or if I can be of any further assistance, please contact me at (602) 277-4224, or khowell@taskeng.net. Thank you.

H:\JobFiles\2302.04\2302.04A\Response to Comments 2302.04A.doc

TOWN OF GILBERT - TRAFFIC ENGINEERING
REVIEW COMMENT SHEET

Project Name:	Cooley Station Village Center & Business Park	**Date:**	9-15-2006
Location:	Williams Field and Recker	**Reviewer:**	Rick A
Consultant:		**Phone No.:**	6841
Plans Sealed By:		**Review No.:**	
Signature of Engineer/Architect			

Sheet Number	Summary of Redline Comments	Consultant Reply
	Traffic Impact Study 1. Report should indicate that trip generation, trip distribution and level of service are to be performed in accordance with the Institute of Transportation Engineers Trip Generation Manual 7th Edition and the Maricopa Association of Governments publications. The traffic stop sign and signal warrant analysis are to be performed in accordance with the Arizona Department of Transportation policies and the Manual on Traffic Control Devices. 2. Page 3, 2nd line, the phrase "located south of Recker" should state "located south of Ray Road". 3. Page 16, figures 5-1 and 5-2, turning movement counts are missing from turning movement diagrams A,B,C,D,H,I,N and S. In addition figures 5-1 and 5-2 do not identify the year for the Peak Hour Study Area traffic. 4. Page 25, figure 11-1, turning movement counts are missing from turning movement diagrams B,C,D,H and I. 5. Page 31, under Traffic Signals, Williams Field Road and access 1 and Williams Field and access 2 are identified as being recommended for traffic signals, however, they are not identified on page 27, figure 12 where all other signal recommendations are identified. 6. Page 31, although this page identifies where right-turn deceleration lanes should be provided it does not address where dual left-turn lanes may need to be provided. 7. Page 32, under the heading Year 2015 coditions, the last bullet states that warranted traffic signals for 2015 are shown on figure 8, however, it is shown on figure 12. 8. Page 32, under Year 2025 conditions the last bullet states that Power Road and Ray Road are recommended for 6 lanes for the year 2025. The study should indicate that this is per the Towns standard since the study data may not support the 6 lanes. 9. Page 33, under traffic signals recommended locations, please see comments in 5 above.	

Comment Codes: A=Will Comply; B=Deleted; C=Consultant to Evaluate

APPENDIX H:

SIGNAL WARRANT PROCEDURES

ENGINEERING DIVISION

TRAFFIC ENGINEERING BRANCH

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

Policy/Procedure Guideline

SECTION 4: Traffic Signals

SUBJECT 4.6: Evaluation of Future Traffic Signal Needs

EFFECTIVE DATE: April 30, 1997

PARAGRAPH:

1. PURPOSE:

This PPG sets forth the procedure and criteria to be used in evaluating future traffic signal needs on projects in the Capital Improvement Project (CIP) program, or in any studies undertaken by or submitted to MCDOT.

2. DESCRIPTION:

ADT volume warrant. This warrant applies at a new intersection, an intersection revised by a proposed roadway construction project, or at the driveway of a new commercial or residential development, and is met when the following requirement is satisfied:

The estimated ADT on the major street and on the higher volume minor street or driveway approach to the intersection equals or exceeds the values in the following table:

Lanes for Moving Traffic on Each Approach		Estimated ADT	
Major Street	Minor Street	Major Street	Minor Street
1	1	10,000	3,000
2 or more	1	12,000	3,000
2 or more	2 or more	12,000	4,000
1	2 or more	10,000	4,000
1	1	15,000	1,500
2 or more	1	18,000	1,500
2 or more	2 or more	18,000	2,000
1	2 or more	15,000	2,000

* Based on the volumes projected to be present within 5 years of the completion of the roadway project, commercial development, or 5-year horizon for Category II, III, and IV developments as per MCDOT Traffic Impact Procedures.

3. EXHIBITS:

None.

4. BACKGROUND:

There is a need for uniform and consistent criteria to be applied in evaluating the need for future traffic signals on various types of projects done by MCDOT or submitted to MCDOT for review. Establishing such criteria will assist consultants, developers and MCDOT in the development and review of future traffic signal needs on these projects.

5. AUTHORIZATION:

By the direction of the Manager, Traffic Engineering Branch, Engineering Division, Maricopa County Department of Transportation.

6. REFERENCES

Manual on Uniform Traffic Control Devices (MUTCD), current MCDOT edition Traffic Impact Procedures, February, 1994.